ATOMIC ENERGY APPROPRIATIONS FOR 1958

HEARINGS

BEFORE THE

SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS HOUSE OF REPRESENTATIVES

EIGHTY-FIFTH CONGRESS

FIRST SESSION

SUBCOMMITTEE ON PUBLIC WORKS APPROPRIATIONS

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ATOMIC ENERGY COMMISSION APPROPRIATION FOR 1958

WEDNESDAY, JULY 10, 1957.

WITNESSES

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B. F. LaPLANTE, SPECIAL ASSISTANT, CONGRESSIONAL RELATIONS

Program and financing

	1956 actual	1957 estimate	1958 estimate
Program by activities:			
1. Raw materials	$281,045,954	$406,663,000	$599,000,000
2. Special nuclear materials	553,093,012	603,476,000	594,253,000
3. Weapons	257,402,452	312,290,000	452,346,000
4. Reactor development	171,229,943	281,713,000	349,200,000
5. Physical research	49,498,523	63,713,000	71,000,000
6. Biology and medicine	28,371,523	31,598,000	36,000,000
7. Training, education, and information	4,651,401	8,827,000	17,500,000
8. Communities	18,770,846	18,067,000	16,515,000
9. Program direction and administration	35,312,925	38,298,000	44,614,000
10. Security investigations	7,525,572	8,916,000	8,772,000
11. Other costs	6,328,155	7,535,000	4,861,000
Total program costs	1,413,230,306	1,781,096,000	2,194,061,000
12. Revenues applied (−)	−29,085,321	−36,137,000	−29,819,000
Net program costs	1,384,144,985	1,744,959,000	2,164,242,000
13. Relation of costs to obligations: Obligations incurred for costs of other years (net)	91,906,254	46,941,000	235,485,668
Total program (obligations)	1,476,051,239	1,791,900,000	2,399,727,668

Program and financing—Continued

	1956 actual	1957 estimate	1958 estimate
Financing:			
Comparative transfers from (—) other accounts	—$47,421,610		
Unobligated balance no longer available	62,727,668	$22,727,668	
Unobligated balance transferred from "Plant acquisition and construction, Atomic Energy Commission" (69 Stat. 354, 450)	—571,400,000		
Appropriation (adjusted)	575,000,000	1,751,900,000	$2,377,000,000
Reappropriation	344,957,297	62,727,668	22,727,668

Obligations by objects

		1956 actual	1957 estimate	1958 estimate
	ATOMIC ENERGY COMMISSION			
	Total number of permanent positions	$7,161	$7,395	$7,494
	Full-time equivalent of all other positions	32	39	39
	Average number of all employees	6,313	6,916	7,120
	Number of employees at end of year	6,637	7,011	7,166
	Average salaries and grades:			
	Grades established by the Atomic energy Commission equivalent to general schedule grades:			
	Average salary	$5,973	$6,115	$6,242
	Average grade	GS-8.1	GS-8.3	GS-8.4
01	Personal services:			
	Permanent positions	$37,149,061	$41,889,738	$43,991,161
	Positions other than permanent	218,923	330,571	326,931
	Regular pay above 52-week base	142,881		169,197
	Payment above basic rates	1,809,344	1,920,309	2,003,595
	Other payments for personal services	30,953	9,382	9,116
	Total personal services	39,351,162	44,150,000	46,500,000
02	Travel	2,810,970	3,500,000	4,000,000
03	Transportation of things	5,642,745	5,944,000	6,294,000
04	Communication services	2,677,683	2,993,000	3,139,000
05	Rents and utility services	232,402,621	229,816,000	210,297,000
06	Printing and reproduction	710,795	618,000	733,000
07	Other contractual services	823,015,457	959,137,748	1,323,455,668
	Services performed by other agencies	14,774,666	30,899,000	28,477,000
08	Supplies and materials	278,879,098	431,021,000	660,592,000
09	Equipment	47,421,610	62,132,000	88,815,000
11	Grants, subsidies, and contributions	727,884	4,619,000	7,900,000
	Contribution to retirement fund			2,740,000
13	Refunds, awards, and indemnities	73,131	93,000	135,000
15	Taxes and assessments	3,831	4,000	4,000
	Unvouchered	248	100,000	100,000
	Total, Atomic Energy Commission	1,448,491,901	1,775,026,748	2,383,181,668
	ALLOCATION TO NATIONAL SCIENCE FOUNDATION			
11	Grants, subsidies, and contributions	10,000		
	ALLOCATION TO GENERAL SERVICES ADMINISTRATION			
08	Supplies and materials	2,933,197	304,053	
	ALLOCATION TO AGRICULTURAL RESEARCH SERVICE, DEPARTMENT OF AGRICULTURE			
	Total number of permanent positions	7		
	Full-time equivalent of all other positions	1		
	Average number of all employees	9		
	Number of employees at end of year	7		
	Average salaries and grades:			
	General schedule grades:			
	Average salary	$5,209		
	Average grade	GS-7.0		
	Ungraded positions: Average salary	$3,832		
01	Personal services:			
	Permanent positions	$57,844		
	Positions other than permanent	698		
	Regular pay above 52-week base	177		
	Total personal services	58,719		

Obligations by objects—Continued

DEPOSITED BY THE UNITED STATES OF AMERICA

	1956 actual	1957 estimate	1958 estimate
ALLOCATION TO AGRICULTURAL RESEARCH SERVICE, DEPARTMENT OF AGRICULTURE—continued			
02 Travel	$2,519		
03 Transportation of things	9		
04 Communication services	368		
06 Printing and reproduction	16		
07 Other contractual services: Services performed by other agencies	49,143		
08 Supplies and materials	4,214		
15 Taxes and assessments	15		
Total, Agricultural Research Service	115,003		
ALLOCATION TO SOIL CONSERVATION SERVICE, DEPARTMENT OF AGRICULTURE			
Total number of permanent positions	2		
Average number of all employees	2		
Number of employees at end of year	1		
Average salaries and grades:			
General schedule grades:			
Average salary	$4,930		
Average grade	GS–7.0		
01 Personal services:			
Permanent positions	$10,229		
Regular pay above 52-week base	64		
Total personal services	10,293		
02 Travel	4,616		
03 Transportation of things	169		
04 Communication services	3		
07 Other contractual services	324		
08 Supplies and materials	237		
Total, Soil Conservation Service	15,642		
ALLOCATION TO NATIONAL BUREAU OF STANDARDS, DEPARTMENT OF COMMERCE			
07 Other contractual services	1,035,696	$221,410	
ALLOCATION TO COAST AND GEODETIC SURVEY, DEPARTMENT OF COMMERCE			
Total number of permanent positions	2		
Number of employees at end of year	0		
Average salaries and grades:			
General schedule grades:			
Average salary	$4,932		
Average grade	GS–6.4		
01 Personal services: Permanent positions	$1,723		
02 Travel	637		
04 Communication services	4		
07 Other contractual services	5		
08 Supplies and materials	5		
Total, Coast and Geodetic Survey	2,374		
ALLOCATION TO THE DEPARTMENT OF THE ARMY			
Total number of permanent positions	63	16	
Average number of all employees	56	15	
Number of employees at end of year	78	14	
Average salaries and grades:			
General schedule grades:			
Average salary	$4,428	$4,453	
Average grade	GS–5.5	GS–5.5	
Ungraded positions: Average salary	$4,323	$4,318	
01 Personal services:			
Permanent positions	$303,326	$89,600	
Regular pay above 52-week base	7,009		
Payment above basic rates	308		
Total personal services	310,643	89,600	

Obligations by objects—Continued

	1956 actual	1957 estimate	1958 estimate
ALLOCATION TO THE DEPARTMENT OF THE ARMY—continued			
02 Travel	1,253	2,000	
04 Communication services	246,339		
05 Rents and utility services	464,473	25,000	
07 Other contractual services	9,917,490	15,761,775	$16,546,000
08 Supplies and materials	6,488	500	
09 Equipment	1,000		
Total, Department of the Army	10,947,686	15,878,875	16,546,000
ALLOCATION TO DEPARTMENT OF THE NAVY			
Total number of permanent positions	164	1	
Average number of all employees	162	1	
Number of employees at end of year	157	0	
Average salaries and grades:			
General schedule grades:			
Average salary	$5,544	$5,544	
Average grade	GS–9.0	GS–9.0	
Ungraded positions: Average salary	$4,780		
01 Personal services:			
Permanent positions	$835,781	$2,741	
Regular pay above 52-week base	3,048		
Payment above basic rates	78,084		
Total personal services	916,913	2,741	
02 Travel	8,097	515	
03 Transportation of things	11,648		
07 Other contractual services	4,225,264	280,645	
08 Supplies and materials	295,356	1,851	
09 Equipment	267,942	17,060	
15 Taxes and assessments	2,760		
Total, Department of the Navy	5,727,980	302,812	
ALLOCATION TO DEPARTMENT OF THE AIR FORCE			
07 Other contractual services	1,598		
ALLOCATION TO GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR			
07 Other contractual services	5,727,821	151,143	
ALLOCATION TO BUREAU OF MINES, DEPARTMENT OF THE INTERIOR			
Total number of permanent positions	142		
Full-time equivalent of all other positions	7		
Average number of all employees	138		
Number of employees at end of year	105		
Average salaries and grades:			
General schedule grades:			
Average salary	$5,532		
Average grade	GS–7.6		
Ungraded positions: Average salary	$4,225		
01 Personal services:			
Permanent positions	$691,006		
Positions other than permanent	26,153		
Regular pay above 52-week base	2,900		
Payment above basic rates	8,784		
Total personal services	728,843		
02 Travel	14,421		
03 Transportation of things	13,019		
04 Communication services	1,646		
05 Rents and utility services	7,151		
06 Printing and reproduction	60		
07 Other contractual services	31,356		
08 Supplies and materials	124,483		
09 Equipment	10,768		
13 Refunds, awards, and indemnities	507		
15 Taxes and assessments	1,640		
Total, Bureau of Mines	933,894		

Obligations by objects—Continued

		1956 actual	1957 estimate	1958 estimate
	ALLOCATION TO FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR			
	Total number of permanent positions	7		
	Average number of all employees	7		
	Number of employees at end of year	7		
	Average salaries and grades:			
	General schedule grades:			
	Average salary	$4,519		
	Average grade	GS–6.2		
	Ungraded positions: Average salary	$3,600		
01	Personal services:			
	Permanent positions	$30,139		
	Positions other than permanent	1,850		
	Regular pay above 52-week base	115		
	Total personal services	32,104		
02	Travel	289		
03	Transportation of things	51		
04	Communication services	144		
05	Rents and utility services	848		
07	Other contractual services	742		
08	Supplies and materials	3,495		
09	Equipment	45		
15	Taxes and assessments	79		
	Total, Fish and Wildlife Service	37,797		
	ALLOCATION TO PUBLIC HEALTH SERVICE, DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE			
	Total number of permanent positions	6	9	
	Full-time equivalent of all other positions	1		
	Average number of all employees	6	2	
	Number of employees at end of year	14	0	
	Average salaries and grades:			
	General schedule grades:			
	Average salary	$5,335	$4,255	
	Average grade	GS–7.0	GS–5.0	
01	Personal services:			
	Permanent positions	$38,763	$13,126	
	Positions other than permanent	11,631	1,833	
	Regular pay above 52-week base	149		
	Total personal services	50,543	14,959	
02	Travel	5,091		
03	Transportation of things	1,425		
04	Communication services	970		
05	Rents and utility services	160		
06	Printing and reproduction	604		
07	Other contractual services	3,599		
08	Supplies and materials	4,225		
09	Equipment	3,590		
13	Refunds, awards, and indemnities	400		
15	Taxes and assessments	43		
	Total, Public Health Service	70,650	14,959	
	Total obligations	1,476,051,239	1,791,900,000	$2,399,727,668

Budget authorizations, expenditures and balances

	1956 actual	1957 estimate	1958 estimate
BUDGET AUTHORIZATIONS AVAILABLE			
Appropriation	$575,000,000	$1,740,400,000	$2,377,000,000
Transferred from "Plant acquisition and construction, Atomic Energy Commission" (70 Stat. 770)		11,500,000	
Adjusted appropriation	575,000,000	1,751,900,000	2,377,000,000
Reappropriation	344,957,297	62,727,668	22,727,668
Obligated balance brought forward	557,251,904	622,598,941	741,687,940
Balance transferred from "Plant acquisition and construction, Atomic Energy Commission" (69 Stat. 354, 450; 70 Stat. 770):			
Unobligated	571,400,000		
Obligated		27,188,999	
Total budget authorizations available	2,048,609,201	2,464,415,608	3,141,415,608
EXPENDITURES AND BALANCES			
Expenditures—			
Out of current authorizations	1,363,282,592	1,077,401,059	1,358,312,060
Out of prior authorizations		622,598,941	741,687,940
Total expenditures	1,363,282,592	1,700,000,000	2,100,000,000
Unobligated balance no longer available (expiring for obligation)	62,727,668	22,727,668	
Obligated balance carried forward	622,598,941	741,687,940	1,041,415,608
Total expenditures and balances	2,048,609,201	2,464,415,608	3,141,415,608

Mr. RABAUT. The committee will come to order.

We have Mr. Strauss here with his group from the Atomic Energy Commission, and we welcome you before the committee.

Mr. STRAUSS. Thank you, Mr. Chairman.

Mr. RABAUT. I presume, Mr. Strauss, you have a general statement.

Mr. STRAUSS. Mr. Chairman and gentlemen, I have. I ought to say for the record the Commission is represented this morning, besides myself, by Commissioner Vance. Commissioner Libby is abroad, and there are two vacancies on the Commission at the present time. I have a statement, Mr. Rabaut, which is, as customary, a secret statement, because it contains considerable amounts of restricted data. We will, as in the past, provide the committee with an unclassified version for the printed record, if that is your pleasure.

Mr. RABAUT. You proceed according to what information you wish to impart to the committee at this time in your statement.

Mr. STRAUSS. Thank you, sir. This will be, therefore, a complete statement, including the secret material.

Mr. FIELDS. The necessary security arrangements have been made.

Mr. RABAUT. You are aware of all the personages in the room?

Mr. STRAUSS. Yes, sir. The reporter reports out most secret meetings in the Commission.

STATEMENT BY MR. STRAUSS

It is again our responsibility, Mr. Chairman, to review with you the national atomic energy program and its related financial requirements. As you know, there has not yet been reported out by the Joint Committee on Atomic Energy, the bill authorizing appropriations for our construction program for fiscal year 1958. This bill will also provide, in keeping with the recent amendments to section 261 of the

Atomic Energy Act of 1954, authorization for appropriations required to carry out our cooperative arrangements with industry under the power reactor demonstration program. As this bill has not yet been reported, the appropriation request covering its provisions has not yet been submitted to the Congress.

With respect to the previously submitted budget for operating expenses, the new authorization is expected to affect only the estimates pertaining to the reactor development program. We are also discussing with the Bureau of the Budget the application of an additional amount of unobligated balances at the end of this year toward a reduction of the 1958 appropriation request. These unobligated balances will become available as a result of cost underruns in some of our programs during fiscal year 1957.

In transmitting to you the appropriation request for the construction program the Bureau of the Budget will also include any amendment to the operating appropriation requested. We therefore are in a position today to review the operating budget request for all programs other than those of the reactor development program.

We will move rapidly to review with the Bureau the request to be submitted as a result of the new authorization and any other amendments which result so that they may be transmitted to you as quickly as possible.

There was favorably reported by the Joint Committee on Atomic Energy on June 6 and approved by the Senate on June 26 an authorization for an additional wing to the Commission's new headquarters building now under construction at Germantown, Md. I do not know when the bill will be considered by the House. These bills, H. R. 6978 of the House and S. 1918 in the Senate, increase the original authorization of $10 million to $13,300,000. No new appropriation is required for this increase as the amount is available from funds previously appropriated as a result of cutbacks in some construction projects and savings which have accrued in others.

There is a real advantage to the Government in beginning construction of the wing at an early date before all work on the basic building is completed. The additional wing will be put out to competitive bidding and as soon as the authorization bill passes the House, we will hope to have your approval to go out immediately for bids on the addition.

Now, Mr. Chairman, I would propose to summarize each of the programs in our operating budget, except the reactor development program, and thereafter the General Manager and staff will at your pleasure go into the details of these programs to the extent that you may desire. This procedure would leave to a later hearing the matters covered in the new authorization bill, which we are now reviewing with the Bureau of the Budget.

SOURCE MATERIALS

The first program that I shall comment upon, Mr. Chairman, is the raw materials program. This is a logical way to take it. We will take the atomic-energy business from the ore straight through the weapons and reactor fuels.

An adequate supply of raw materials, particularly uranium, is indispensable for the development of both military and peaceful uses of atomic energy.

(Discussion off the record.)

DEVELOPMENT OF CLEAN WEAPONS

Mr. STRAUSS. I will depart from the prepared text here to say that in the course of the tests in 1956, those which took place at the Pacific proving grounds and those which are currently taking place in Nevada, there is particular emphasis on two approaches.

(Discussion off the record.)

Mr. STRAUSS. Our laboratories have now succeeded in producing the prototypes of weapons in which the radioactive fallout is reduced as against previous weapons by as much as 96 percent, and in a recent visit to Washington on the part of some of the scientists connected with the weapons laboratories they have expressed the belief, and these are men who in the past have demonstrated their ability to convert their beliefs into performance, that in 4 or 5 more years it should be possible to clean up weapons of radioactive fallout completely. I thought that might interest you.

Mr. EVINS. How do you clean up a bomb, Mr. Strauss?

Mr. STRAUSS. If I knew how to do it, we would not have to employ Dr. Teller and Dr. Lawrence, et al. But it consists in general of this. The objectionable, hazardous parts of fallout are the isotopes that are created as a result of the fission reaction in the weapon.

(Discussion off the record.)

Mr. STRAUSS. As I say, they have been able to clean them up to the extent of 96 percent.

Mr. EVINS. So that now you drop a bomb and kill a squirrel and not the leaves around it.

Mr. STRAUSS. I think it will kill several squirrels but you are quite right; the effect is confined to a target rather than to a large indiscriminate area downwind from the target.

RAW MATERIAL COSTS

Now, the estimated cost of the raw materials program in fiscal year 1958 is $599 million. The increase of $192 million over the preceding year is due entirely to the larger quantities of uranium concentrates which we will receive. Our procurement of uranium concentrates was about 10,500 tons in fiscal year 1956, and 16,300 tons in 1957. In 1958 we expect to receive 27,400 tons, more than the combined total for 1956 and 1957.

The achievement of these levels of uranium production represents the fulfillment of policies and measures adopted many years ago. The basic decision was to place primary reliance on the privately financed mining industry. For its part the Atomic Energy Commission established guaranteed prices for United States production of uranium and made clear its willingness to enter into long-term contracts with foreign suppliers.

In the United States the mining industry responded by developing the uranium deposits and building the mills to recover the concentrates. It is pertinent I believe to note that in 1958 the United States production will amount to 38 percent of the 27,400 tons projected.

While we budget annually only for the uranium we expect to receive during the budget year, forward commitments for uranium procurement are very substantial. On the basis of current estimates of quantities to be delivered from United States sources under our guaranteed price schedules, and from foreign sources under our current agreements, we estimate the total commitments to be about $4.5 billion.

For domestic production, guaranteed prices have been established for uranium ore delivered through March 1962, and for uranium concentrates from that date through December 1966.

PRODUCTION OF SPECIAL NUCLEAR MATERIALS

Special nuclear materials. This is the next step after the ore and the concentrates. This program is concerned with converting raw materials into special nuclear materials—the key products from which nuclear energy is released in weapons and in reactors.

Of the Atomic Energy Commission's total plant investment about three-quarters represents facilities to produce such materials from the ores. Our present plans include no provision for any major physical expansion of these production facilities. It would look, on the basis of the present situation, as though our production facilities have stabilized. But we are continuing to concentrate on the development of the full potential of existing plants through process improvement.

The $594 million estimate in the budget for this program in 1958 is approximately $8 million more than the 1957 estimate. This increase appears relatively small, as compared with the increase in the combined amount of materials produced. In these operations the uranium concentrates are purified and converted through successive steps into uranium hexafluoride gas for the diffusion cascades and into metal fuel elements which go into the reactors at Hanford and Savannah River.

The large-scale cascade improvement program which we undertook in 1956 is being continued. Its objective, in brief, is to improve the efficiency of the diffusion plants in separating the scarce uranium 235 isotope from the abundant and only slightly heavier normal uranium, uranium 238. Substantial gains in diffusion plant efficiency have already been achieved and more are in prospect.

(Discussion off the record.)

Mr. STRAUSS. At this time, Mr. Chairman, it should be noted that there will be a general increase in 1958 in the output of the reactors, the gaseous diffusion plants, and in the feed materials production chain generally, and that in each case these production gains will result in lower cost per unit.

As our production plans mature, it has become possible to curtail certain operations. Two major plants are now being placed in standby and will not be in operation during 1958. One is the heavy water production plant at Dana, Ind.

The demand now foreseeable for heavy water can be met more economically by operating just the other heavy water plant at Savannah River, and an orderly shutdown of the Dana plant is in progress.

Operation of the tributyl phosphate plant at Hanford has also been terminated. During the past 5 years this plant has been used to recover salvageable uranium from the stored waste solutions from the original Hanford separation process running back to the Manhattan

District days which did not separate the uranium from the fission products. The process became obsolete with the introduction of the more efficient Redox and Purex separations plants in which both plutonium and uranium are recovered simultaneously.

PROCESS DEVELOPMENT

Process improvement is as vital to the health of the atomic energy industry as to American industries in general. The projected costs of $34,100,000 in 1958 for process improvement in the special nuclear materials program is slightly higher than in 1957. The resultant increased safety, efficiency, and economy are reflected, as I have said, in the lower unit cost of the products.

WEAPONS PROGRAM

The next step in the chain, from raw materials, and then to special nuclear materials, is weapons. The weapons program covers research, development, testing, engineering, manufacture and assembly of fission and thermonuclear weapons and their storage. Existing weapon designs are continually being improved to increase their reliability and safety, to improve their deliverability and usability, and to meet the evermore exacting military characteristics of modern weapons systems.

For the weapons program in fiscal year 1958, we anticipate costs of $452 million, which is an increase of $134 million over 1957.

(Discussion off the record.)

Mr. STRAUSS. As a final matter relative to the weapons program, I would like to take a moment to describe certain aspects of our present situation and future plans relative to the development of these clean weapons. After the high-yield tests in the Pacific in 1954, the Commission inititiated a program to find ways and means of reducing the residual contamination from high-yield detonations.

(Discussion off the record.)

RESEARCH IN PHYSICAL SCIENCES

Mr. STRAUSS. Physical Research: The whole program, Mr. Chairman, is based upon physical research. The production of the fissionable material, the manufacture of the weapons, the manufacture of the fuel elements that go into the reactors, all stem from the health and the vigor of the physical research program of the Commission.

In essence this program provides the fundamental knowledge not only for the past, but for the future development of the atomic energy program in the United States and the continued maintenance of our leadership throughout the world. Although some of the activities of the program are directly geared to our operating plants, the bulk of the current effort in physical research is aimed at long-range benefits. Many of our earlier "test tube" experiments are already incorporated in improvements in our day-to-day operations.

You are all alert to the need to know more about the fundamental properties of matter and the laws which govern its components, and this may be said to be the precept of our physical research program. Today that program embraces physics, chemistry, metallurgy and mathematics with about 70 percent of the program carried on in our

own laboratories, and the remainder contracted to university laboratories where the work is often integrated with postgraduate training in research.

DISCOVERY OF NEW ELEMENT

The increase in operating costs for physical research in fiscal year 1958 is in recognition that our expanding knowledge has opened up new vital areas of research in atomic energy. It was announced only yesterday, as an interesting commentary, that one of the people in our Argonne Laboratory collaborating with scientists in two international laboratories, had isolated a new element in the atomic table which has been named after Mr. Nobel.

The field of high energy physics features the work of power accelerators such as the bevatron in California and the cosmotron at Brookhaven, in which the antiproton and antineutron were first produced and identified. Additional funds will permit our scientists to improve their equipment and utilize existing accelerators on a round-the-clock schedule, which holds the key to a fuller understanding of nuclear force.

Another important field of research deals with the nuclear properties of reactor fuels and the numerous other materials now in use or potentially useful in reactor moderators, coolants, structural materials, and fuel cladding. A 14-percent increase over 1957 has been provided in the estimated 1958 cost of $12 million for this type of research.

The research on chemical properties and reactions shows an estimated increase of about $2 million in 1958 to a figure of $14 million, and represents about two-thirds of the research proposed for chemistry. Most of the increase here is planned in the investigation of high-temperature chemical reactions, which are a special concern in reactor development, chemical reactions resulting from nuclear transformations or from radiation and bombardments by nuclear particles, and processes leading to the production of new forms of nuclei which can be synthesized in large accelerators.

RESEARCH IN BIOLOGY AND MEDICINE

Another and equally important part of our research program is in biology and medicine. Research projects on the effect of radiation, including the effects on biological systems, the study of biomedical problems in atomic energy operation and the combating of the detrimental effects of radiation together represent about two-thirds of the $36 million requested for the biology and medicine program.

At the Argonne Cancer Research Hospital, one of our leading investigators recently succeeded in isolating a substance believed to be responsible for the production of red blood cells. This was an especially significant development in that it could lead to effective means of treating disorders of the blood-forming organs of the body which result in leukemia and aplastic anemia. This research was accomplished by the use of a radioisotope, in this case radioactive iron.

At the Oak Ridge National Laboratory and other locations, substantial progress was made in the prevention and treatment of injuries resulting from radiation. There was further development of a bone marrow preparation which, when administered to animals some

hours after exposure to radiation, enables these animals to recover from what in untreated cases would be fatal doses.

RADIATION EFFECTS STUDIES

While these examples are among the more dramatic which have occurred in the program in the past year, they are, nevertheless, typical of the progress being made in our efforts to utilize atomic energy for the benefit of man and likewise to protect human beings against the harmful effects of radiation. No aspect of radiation effects has aroused more public interest and understandably so, and I might add, has occasioned more irresponsible statements in some quarters, than the question of whether or not radiation over several generations may have a harmful and irreversible effect on human-inherited characteristics. The Commission is vigorously engaged in researching all useful data on such genetic effects of radiation. This work we hope to expand during 1958. During last year, the National Academy of Sciences published after an exhaustive study a comprehensive and, at its date, definitive report on this subject, based almost completely on the data which had been provided by the Atomic Energy Commission as there was no other place in the world where such information could be obtained.

BENEFICIAL APPLICATIONS

Among the beneficial applications of atomic energy, the use of radiation in diagnosis and treatment of disease continues to be rewarding. The work at Argonne Cancer Research Hospital in Chicago has been mentioned. At Brookhaven, new techniques are being developed for the selective radiation of tumors and progress is being made in the treatment of brain tumor in patients with neutron radiation in the Brookhaven reactor.

The completion which is scheduled for early fiscal 1959 of the first reactor specifically designed for medical research alone, as a part of the New Brookhaven Medical Research Center, will be a major step forward in our attack on the deadly scourge of cancer.

New applications for radioactive isotopes in both medicine and agriculture are continually being developed. By labeling compounds which become a part of basic body substances such as proteins and hormones, we are now beginning to understand in greater detail the complicated biochemical changes which occur during a variety of diseases.

In agricultural research we use these radioactive tracers to discover how insecticides exert their toxic effects, and also to determine what nutrients are essential in plant growth and at what particular times these nutrients are utilized in the life cycles of plants. Radiation sources are also being utilized, as I am sure you know, to produce useful mutations in plant breeding studies and several very valuable crop mutations have been developed in consequence, one of which has been saving the agricultural community of the country an estimated $200 million a year.

TRAINING, EDUCATION, AND INFORMATION

The next subject, Mr. Chairman, is training, education and information. In previous appearances before this committee other

members of the Commission and I have discussed the urgent need for providing both our own citizens and the citizens of friendly nations abroad with adequate training, education, and information on nuclear technology. For the first time in our budget presentation these activities have been consolidated under one heading which reads, "Training, education and information." The functional categories with the 1958 budgetary amounts under this heading are the following:

Operation of Commission schools primarily at Oak Ridge and Argonne Laboratories, $1,740,000. Fellowship awards, $1,015,000. Equipment grants to universities and faculty training courses—$8,705,000. Participation in international technical conferences and assistance surveys for foreign nations, $2,850,000. Dissemination of atomic energy information, $3,190,000, for a total of $17.5 million.

The enactment of Public Law 1006 last summer, which amended the Atomic Energy Act, authorized the Atomic Energy Commission to make financial grants and contributions to institutions for training equipment in nuclear technology. By this approach we enable existing educational institutions to meet the urgent need for training rather than establishing new schools.

COOPERATION WITH OTHER NATIONS

Since the President's announcement of the atoms-for-peace program, the Commission has been working in close cooperation with friendly nations to provide the foundation for more widespread understanding of the peaceful uses of atomic energy. We have negotiated 51 bilateral agreements for cooperation with 43 separate nations.

A second international conference on the peaceful uses of atomic energy is planned for next year. I am sure you will recall that the first such conference which we initiated was an outstandingly successful event of 1955. Over 300 United States personnel have visited 58 countries to give advice and guidance. Training in nuclear technology and use of radioactive isotopes has been provided 300 foreign students from 52 countries.

Research reactor project grants—which come from mutual security funds, not from our appropriation—have been made to seven countries and a number of such applications are pending. Over 1,500 visits by foreign nationals to our installations have been arranged. Thus we are assisting friendly nations in their own programs for the peaceful uses of atomic energy.

Yesterday I received some 50 industrialists from France, Germany, Belgium, Luxembourg, the Netherlands, and Italy, who are here visiting our installations. These are countries and firms from which a very considerable amount of business in the nuclear energy field is practically certain to result for American business.

The President has, as you know, recently approved the allocation of 50,000 kilograms of uranium 235 for foreign peaceful uses. It was originally 20,200 kilograms and was increased by 29,800 kilograms a few days ago. This material will not be given but will be sold or leased over an extended period of time, it being estimated that some 20,000 kilograms will be made available over the next 10 years. We plan to continue on a self-sustaining basis to make material and processing services available and to continue to enlarge the participation of American industry in this program.

The budget estimates before you contain an item of $2,850,000 directly attributable to this program of cooperation with other nations—$2.5 million for the second international conference on the peaceful uses of atomic energy, and $350,000 for survey teams to assist cooperating countries in developing their own programs. In addition, staff studies and consultations will continue to be made.

The Senate has recently ratified United States participation in the International Atomic Energy Agency. We have every expectation that this agency will provide a framework of inspections and controls which will insure against the diversion of material for purposes of war and aggression and will establish health and safety standards on a worldwide basis in the field of radioactivity.

We will continue to operate the reactor training schools for American and foreign students at Oak Ridge and Argonne National Laboratories. Support is also budgeted in 1958 for the establishment of a nuclear training center for Latin American students at the University of Puerto Rico, which center was opened in January of this year.

INFORMATION SERVICES

As the development of nuclear knowledge proceeds at a growing pace, arrangements for its compilation in forms best adapted for use and its dissemination to all who can make use of it assumes increasing importance. In many ways we are enlarging the scope and coverage of our technical information services. The $1,100,000 increase in 1958 over 1957 in this item is accounted for by the growth of the Commission's work with private industry. By new publications supplied to libraries, by providing reference services, abstracts, indices, bibliographies and more and better exhibit material we will enable our engineers, scientists, and teachers to make the widest use of the knowledge which has been accumulated and which continues to grow.

COMMUNITY OPERATIONS

The sale of real estate at Oak Ridge and Richland by the Housing and Home Finance Agency continues. The budget estimates before you are based on a projection that by June 30, 1958, residential disposal would be 80 percent complete at Oak Ridge, and 50 percent complete at Richland. The effect of property disposal in the budget estimates for fiscal year 1958 is to reduce the Oak Ridge and Richland community operating incomes by $3,900,000 below the 1957 level while reducing the costs by $1,700,000. As the cost of providing municipal services will continue to be borne by the Commission until the incorporation of these communities, which will not take place until after fiscal year 1958, and as the charges made for municipal and utility services, required by statute to be based on locally prevailing rates, are not sufficient to cover these costs, the total community budget for the first time in 5 years shows an excess of costs over revenues estimated to be $1,600,000. As in the past the other community and housing projects of the Commission which includes notably Los Alamos, will continue to operate with an excess of revenues to the Government over the costs of operation.

PROGRAM DIRECTION AND ADMINISTRATION

The item for program direction and administration is a measure, Mr. Chairman and gentlemen, of the efficiency of operation of the Commission. With the great growth in operation and research activities we have noted, some increase in overhead costs might be expected to occur. The Commission's administrative cost estimates, in fact, do rise somewhat in fiscal year 1958. Program direction and administration costs, however, continue to decline in relation to total operating costs, from a ratio of 2.5 percent in 1956 to 2.1 percent in 1958. They were 2.2 percent in 1957. You can see that there has been a steady decline over the years in the ratio of our administrative costs to the total operating costs.

Included for the first time in 1958 is the contribution to the civil service retirement fund covering Atomic Energy Commission employees, as is now required by Public Law 854, enacted in 1956, and amounting in our case to $2 million. Slightly less than a 4 percent increase in authorized year-end administrative employment is planned for fiscal year 1958, and all of this will be in our field offices where these few additions are due to compliance inspection of licensees, industrial participation and the expanded activities relating to weapons, and to civilian and military reactors. Some increase in travel funds in 1958 also is required as a result of the inspection, industrial participation, accelerated reactor development and international conferences and cooperative activities.

Mr. Chairman, I have attempted to outline briefly the budget aspects of our major programs other, as I have said, than reactor development and construction. These we will have to present to you after proper authorization by the Joint Committee, and at this point you may care to ask questions of the General Manager and the staff, and of our key directors who are here. We will be happy without reserve, in this executive session, to answer anything that you put to us.

NATURE OF FUEL ELEMENTS

Mr. RABAUT. Thank you, Mr. Strauss.

Now you have touched, as you have said in your general statement, upon the different subjects as set forth under the tabs here, No. 1, of the operating budget. We will, of course, have general questioning under the tabs as set forth in the book. I say this in order that we may not get off on tangents in talking about them at this time, but if there are some general questions to be asked of the group here today, as indicated by the statement of the Commission, we can ask them at this time.

Now, I made a few notes here as a matter of information. You used the term "metal for fuel elements." Please explain this term in a little more detail.

Mr. STRAUSS. The uranium is fabricated into shapes which originally in the old reactors were called slugs. They were roughly like pieces of a bar 6 or 8 inches in length, an inch or an inch and a half in diameter, encased in aluminum, sealed in aluminum cans, and placed into tubes or channels in the reactor which was built of graphite blocks, and which acted as a moderator. When a sufficient number of these slugs or fuel elements had been inserted and where they were

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in close proximity, a chain reaction occurred; a critical mass was present, and a chain reaction occurred. With the development of the art, all sorts of modifications in fuel elements have been made. Some of them are pellets. Some of them are wires. Some of them are no longer solid, but are liquids or slurries.

Mr. RABAUT. That was the reason you used that expression; it is metal for fuel elements.

Mr. STRAUSS. Yes, sir. I would like to say I would like to be corrected if I have given you any wrong information. Dr. Johnson, have I said it correctly?

Dr. JOHNSON. I think you have made a very clear statement of it.

Mr. STRAUSS. It is a mistake to call it a fuel. This slang has grown up. It is not a fuel in the sense that it is burned by being oxidized as coal or oil or wood. It is a fuel only in the sense that it produces heat.

SHUTDOWN OF DANA PLANT

Mr. RABAUT. Now I think I asked you about this last year, and I am going to ask you again. In regard to the term "heavy water," you say you are going to discontinue the Dana plant. What is the value of that plant that you are going to discontinue?

Mr. STRAUSS. In dollars?

Mr. RABAUT. Yes.

Mr. STRAUSS. We can give you a figure of its cost, which was about $100 million. I would say, however, that its present value is nil in the sense that it cannot be used for any other purpose that we know of. But it is in standby, and it is conceivable that conditions might arise under which we would wish to put it in operation again. I cannot predict that with any degree of assurance. We have given no such assurance to any of the people who work in it.

Mr. RABAUT. What leads to the discontinuation of its use? Can you produce a sufficient quantity in another plant?

Mr. STRAUSS. Yes. We have a more modern plant at Savannah River which can produce more cheaply, and we have accumulated a stockpile of heavy water. The continuance of the Dana plant at a cost of $13 million per annum has been saved.

Mr. RABAUT. What is this heavy water?

Mr. STRAUSS. Heavy water, sir—and again I shall ask to be corrected—heavy water is an isotope of ordinary water; that is to say, it is ordinary water which has an isotope of hydrogen, heavy hydrogen in place of normal hydrogen in its molecule. It exists in ordinary water in very small concentrations and is extracted by an electrolytic process requiring large amounts of heat and electrical energy, and a great deal of plant investment.

Mr. RABAUT. Do you use considerable quantities of it?

Mr. STRAUSS. We use considerable quantities of it in the reactors at Savannah River and sell considerable quantities of it. We expect to sell more to foreign countries at a price which returns our cost plus amortization of the plant.

Mr. FIELDS. The requirement for it existed at the time that the Savannah River plant was constructed. It took a very large inventory of heavy water to put the plant into operation. We needed two heavy-water plants for several years, in order to meet the schedule of military requirements for production from that plant.

Mr. RABAUT. In other words, the necessity of the first plant was to get the second plant going.

Mr. FIELDS. Two heavy-water plants were required to get the production plant at Savannah River going. The huge reactors are loaded with this heavy water in very large quantities. They are now filled and all we have to do is to maintain the losses in those plants.

Mr. RABAUT. What roughly is the value of heavy water?

Mr. STRAUSS. $28 a pound.

Mr. RABAUT. What do they use it for?

Mr. STRAUSS. You mean outside of atomic energy?

Mr. RABAUT. Yes.

Mr. STRAUSS. It may have some very small demand in laboratory use for experimental purposes, but I know of no use for this in quantity except as a moderator in reactors. Is there any other use, Dr. Johnson?

Dr. JOHNSON. Not that I know of.

Mr. FENTON. What is heavy water, water plus hydrogen?

Mr. STRAUSS. No, it is water in which the hydrogen ratio instead of being H_2O, is H^2_2O. It is an isotope of hydrogen which has replaced the normal hydrogen, that is, takes the place of normal hydrogen in water.

SALVAGE OF SPECIAL NUCLEAR MATERIALS

Mr. RABAUT. Now, you referred to the necessity for new lighter weapons. Is there much salvage to be derived from the older-type weapons that are in stockpile?

Mr. STRAUSS. May I refer that question to General Starbird, the Chief of the Military Applications Division?

General STARBIRD. There is, certainly. All of the special nuclear material can be salvaged and could be used again.

(Discussion off the record.)

REACTOR TRAINING SCHOOLS

Mr. RABAUT. Now, you said something about schools and American and foreign students.

Mr. STRAUSS. We have 2 schools, 1 at Argonne and 1 at Oak Ridge, but we try to use existing universities to the greatest possible extent in order not to have to provide facilities.

Mr. RABAUT. The reason I ask this question is that some years ago when we entered upon the airplane program we had no pilots, and we had quite a problem here to get pilots properly trained. This is somewhat in the same category now; this is something new. It is not new to you men, but it is new to a great many people in the world, and what we need is teachers and scientists in this line.

Now, you say there are both American and foreign students there. I was wondering if you had any idea of the percentage of those students, the nationalities, and so forth?

Mr. STRAUSS. In some of those schools the foreign students predominate because the schools are largely for them. They are not in a position, for example, to go to our universities, which are open to our own students, and where a certain number of credits in subjects other than science are necessary for matriculation. The principal difference between the analogy that you presented a moment ago, the very interesting analogy of pilot training and the training for scientists is that if the man has a physical capacity to become a

pilot—his reaction time and intelligence are adequate—a pilot can be made, let us say, in a year or less. In the stress of war, we made them in much less than a year. That is not true of this field we are speaking of. There is a certain amount of basic scientific education that is necessary that might be as much as 3 years and a top off of the postgraduate course of 1 or 2 years more on top of that before they could be people who would be qualified to operate the kind of hazardous and expensive plants that will be built in foreign countries or will be built here.

Mr. RABAUT. So you say the majority of them in these two schools you have are foreign people?

Mr. STRAUSS. I said in some of the schools that are designed specifically for foreign students.

Mr. RABAUT. Do you have any idea of the percentages?

Mr. MCCARTHY. At the international school at the Argonne Laboratory, 75 percent of the students are foreign students and 25 percent are from American industry. The students at the Oak Ridge School of Reactor Technology are practically all American.

The output at the school at Argonne is 120 students per year. The output at ORSORT is on the order of 120, going to 240 in fiscal year 1958.

Mr. FIELDS. We also send students to Pennsylvania State University and North Carolina State College for training in reactor technology.

Mr. RABAUT. Do you send them to other places, too?

Mr. FIELDS. These are the only two places where we have courses of this nature at the present time.

GRANTS FOR TRAINING EQUIPMENT

Mr. RABAUT. What about the schools that you send valuable material to?

Mr. FIELDS. That is not students. That is for assistance in the form of grants for training equipment, which may be small training reactors and other equipment for conducting of engineering studies. They are used for training in reactor technology or in biology and medicine dealing with radiation. Last year we made grants of $3 million in equipment to about 25 universities.

Mr. RABAUT. Are these sent simply to schools because of their size or are they sent to schools because of their know-how and development in certain lines?

Mr. STRAUSS. It is because the teachers are there; the men who are specifically qualified to instruct them in these subjects.

Mr. FIELDS. Grants are made on the basis of a request from the school after a thorough review to insure that they have an engineering course or a graduate engineering course that is competent. They lay out a plan over the years as to how they are going to conduct the course, and how they can utilize the equipment effectively. We have set a limit of $350,000 per school for this purpose.

Mr. RABAUT. $350,000 per school?

Mr. STRAUSS. Yes.

Mr. RABAUT. What was the total amount?

Mr. STRAUSS. It was $3 million last year and we are asking for $6 million this year.

Mr. RABAUT. Are you seeing results from this program that are encouraging to you?

Mr. STRAUSS. Moderately so. The people who come out are very good. The only thing that is not encouraging, Mr. Chairman, is the fact that we think that the numbers ought to be larger. On the other hand, we are not in a position, and I don't suppose anyone is, to provide the students. The secondary schools in the United States are the bottleneck. This is beyond the capacity of the Atomic Energy Commission or even the Federal Government to do anything about. Those of us who speak on the subject, including members of the Commission and employees of the Commission, take every opportunity in going about the country to impress upon the communities in which we are visiting the importance of restoring science to the position it formerly occupied in the secondary school system in the United States, in order that the needed human material may reach the universities.

Mr. RABAUT. Can you develop students in your schools to the point where they get degrees?

Mr. STRAUSS. Most of the students that come into the schools that we are talking about are graduates, and have degrees.

Mr. RABAUT. They have a graduate degree. But have you the power to confer a higher degree?

Mr. STRAUSS. No, the Commission confers no degrees, but the institutions with which the Commission is dealing are in a position to grant degrees. Whether they grant degrees for these short courses or not, I doubt. I am advised that they do not.

SHORTAGE OF SCIENCE TEACHERS IN SECONDARY SCHOOLS

Mr. RABAUT. Can you have a relationship with some other schools that would give degrees to your students when they graduated? I am thinking of building up a teachers unit in this country so that we could get this in the secondary schools eventually.

Mr. STRAUSS. We have summer courses for teachers. We do what we can for that purpose, but the shortage of science teachers in the secondary schools is more deeply rooted than lack of supply. It is because the pay schedule available to teachers in secondary schools is so low that you cannot get a man qualified to teach science unless he is a very devoted person. Industry will hire him or the Government will hire him at a much greater salary to do a more immediately pressing job, but a job which perhaps does not equal, in long-range importance, the job of teaching in the secondary school.

Mr. RABAUT. I think it is very well that you have made that observation.

Mr. STRAUSS. I will be glad to send you something that I prepared on the subject.

(The information follows:)

FREEDOM'S NEED FOR THE TRAINED MAN

Remarks Prepared by Lewis L. Strauss, Chairman, United States Atomic Energy Commission, for delivery to Sixth Thomas Alva Edison Foundation Institute, Hotel Suburban, East Orange, N. J., Monday, November 21, 1955

> "* * * ourselves and children have lost, or do not learn for want of time, the sciences that should become our country."
>
> [Shakespeare (Henry V)]

If there is to be another war among the great nations of the world before the human race discovers a method of abolishing recourse to combat, that war may be survived by the country with the greatest stockpile of nuclear weapons and instruments of their delivery. But such a war will almost certainly be lost by the country with the fewest resources in trained manpower.

This is a conclusion which has been reinforced for me by experiences during the past 15 years, first with the research activities of the Navy and later with the Atomic Energy Commission. In the latter area, there are three components necessary to success in meeting our established objectives. These are, first, the elemental raw material, second, the required funds, and third, human skill and intelligence.

Early in the work of the Commission, it looked as though the raw material would be a limiting factor. Most of our uranium was mined in Africa. By setting incentive prices which vigorously stimulated exploration and prospecting all over the world (and especially within our own borders) we have stepped up the production of this vital material to a point literally undreamed of 10 years ago.

The second requirement—money—has never been denied to the enterprise by the Congress. The appropriation of money is an expression of the degree of the concern and interest of the American people—their concern with their security and defense, and their interest in supporting discovery—a national characteristic since the earliest settlers reached our shores.

The third and indispensable component of success obviously is gray matter. Here, also, we have been fortunate, until now. But while we can look ahead and see no indications of dearth in raw material or means, the prospect for trained minds is a very different and gloomy one. Deposits of uranium can be located, opened, mined, and converted into metal in a very short time. Appropriations can be voted quickly whenever the Congress decides them warranted. But men and women cannot be qualified in disciplines so exacting as modern science without a dedicatory period—an apprenticeship—of years.

If you are concerned with the reasons for apprehension that this third component of progress and defense is in any way endangered—and I believe that it is—then this occasion associated with the memory of Thomas Alva Edison, the possessor of a self-trained mind—and therefore one of the great and unique exceptions—seems an appropriate opportunity to discuss the facts.

The recent conference in Geneva on the peaceful uses of atomic energy produced a number of notable results, which was perhaps to be expected since it was the greatest scientific gathering ever convened. Some of these results already are evident; others will materialize as new inventions and refinements in many facets of the nuclear art bear fruit from the cross-fertilization of Geneva.

An immediate result was that we learned much about the quality of Soviet science, in terms of both the individual and the products of his talents. And what we learned was sufficient to shatter any complacency we may have enjoyed in regard to our own imagination and ability. Too many of us have fallen into the easy attitude of assuming that the Russians, because of what we have observed of the sinister purposes and slave methods of their political system and the compartmentalization of their research, could never match us in scientific initiative and progress.

This was dangerous self-delusion. Actually, the emphasis which the Soviets are placing on science and particularly on the training of new young scientists and engineers, presents a real and growing challenge to us, and to the free world.

Today their technical schools and universities are turning out scientists and engineers who are well-trained and highly competent. Since Geneva we know this. The quality may differ from field to field, but generally speaking, their first-rank men appear to be as good as our own.

The Soviet challenge is not one of technological quality so much as of numbers. It is evident that we are rapidly falling behind Soviet Russia in the training of engineers and scientists. The level of our reservoir of trained brainpower is dropping, in relation to the demand. They, on the other hand, are striving to fill theirs to capacity as rapidly as they can.

The facts and figures speak for themselves and they are not pleasant facts and figures. I should say here that their absolute accuracy cannot be assured, which is the case with most data from the dark side of the Iron Curtain, but they deserve and demand the prompt attention of everyone who is interested in the continuation of our prosperity and in preserving our security and in maintaining peace.

We do know with certainty that we are turning out less than one-half the number of scientists and engineers we require—an alarming statistic by itself. You may have noticed that, each Sunday, from 6 to 10 pages of the metropolitan

press are filled with advertisements attempting to enlist scientists and engineers to fill waiting jobs. These advertisers are for the most part the industries to which we look for the tools and weapons of our defense.

Inevitably our shortage of scientific manpower will become worse before we can do anything to correct it. This is an inescapable fact.

At present, we are about even with, or perhaps slightly ahead of the Soviets in numbers of trained scientists and engineers—about 1 million in each country and, in Russia's case, for an industrial establishment far smaller than ours. At the moment we probably have more topnotch men than they have, since about half of those presently at work in the Soviet Union were trained under inferior prewar standards. However, last year Russia is estimated to have produced as many doctors of science as we did.

Russia has some 520,000 graduate engineers, and we may be sure that substantially all of them are engaged upon the work for which they were schooled. We presently have a somewhat larger number of graduates, but this is more than offset by the fact that only 65 percent of our engineers are actually working at their professions. A third of them have gone into executive jobs, or have wandered off into sales promotion, finance, and other lines of work.

We require from 45,000 to 50,000 new trained engineers every year. We are getting half that number. Last June's crop was around 23,000. Russia at the same time, produced 53,000 new engineers and is expected to substantially increase that number next year and each year thereafter. She is graduating 120,000 new scientists and engineers of all types this year, which compares with our total of 70,000 graduates.

Between 1950 and 1960, which may be the most critical decade of our national existence, Russia is expected to produce 1,200,000 trained engineers and scientists, against our 900,000.

In the face of figures such as these, we cannot take refuge in thinking that this Soviet crop is of an inferior, mass-production grade, or that they cannot maintain their high rate of output.

The fact is that the sciences have an overriding priority in Russian education. More than half of all Russian university graduates are in the science-mathematics fields; only one-fifth of our graduates are in those fields. Russian doctors of philosophy, or the equivalent, are 3 to 1 in favor of science and engineering; in the United States the ratio is just the reverse—nearly 3 doctorates in the humanities for every 1 in science and mathematics.

Where is the answer to this challenge to be found? Where are we to obtain the trained men to replace the present personnel in our laboratories and science faculties and industries as they retire or pass away, and to fill the expanding demand in every field for more and more scientifically trained people? The trouble does not rest, I think, at the end of the line of training, that is to say in our colleges and universities. They cannot create the candidates for these posts without the human material to start with. The difficulty lies more deeply in our educational system. Our graduate institutions cannot supply the scientists and engineers we need, if students do not come to them, ambitious to be scientists and engineers and possessed of adequate high-school preparation for such careers. The decisions that produce our skilled scientists and technicians are made, in the main, before they arrive on the college campuses.

Only about 16 percent of the high-school graduates entering college last year enrolled in engineering courses—or about 66,000 of them. That is not an entirely gloomy statistic, because the ratio has been going up, slowly but steadily, since 1950 and is expected to hold fairly steady around that 16 percent for several years to come. However, this must not be construed to mean that we will have 66,000 or more graduate engineers each year. Attrition, on the basis of our experience, will take a heavy toll. More than half of these 66,000 young hopefuls will flunk out along the way, or switch to other, easier courses. Ask the deans of our engineering schools for the reason and a composite of their answer is: "poor high-school preparation in science and mathematics."

Our high school systems—or, to be more accurate,—you and I—are failing in our obligation to our national welfare and security. We fail when we squander the most valuable of our natural resources. Our youth is not being exposed to the excitement and challenges of science. We are not equipping the growing generation to protect or even to fully enjoy their modern heritage.

Large numbers of our high-school students have no opportunity to discover whether science and engineering appeals to them, because preparatory courses are not available, or—when such courses do exist—they often are taught by instructors who double in science, but whose interests lie in other subjects.

A recent survey indicates that from 250,000 to 400,000 high-school students in our country presently are learning mathematics from teachers not trained to

teach it, and the same situation prevails in science teaching. Government figures show that part-time science teachers in our schools outnumber full-time science teachers.

Since there are not enough trained teachers to go around, the alternative becomes one of using unqualified teachers, or abandoning those courses. In an appalling percentage of instances, as I shall cite in a moment, the courses have been abandoned.

The problem becomes a chain reaction in reverse, because fewer and fewer high-school courses in math and science mean fewer and fewer college students of science and engineering, and fewer graduates. And fewer graduates mean fewer persons with either the inclinations or equipment to teach science and mathematics in the high schools. Thus, the teacher shortage grows progressively worse.

A graduate scientist or engineer cannot reasonably be expected to choose a teaching career at a salary so low that he may be compelled to take an after-hours job, often of a menial nature, to even make ends meet * * * when he has the option of a number of better paying jobs elsewhere. This has made it easy for industry to attract the people who would be science teachers, and thus the seed corn is eaten up with no concern for the future.

Our high-school enrollments are growing but there are fewer college graduates to teach them. The number of qualified teachers of science and mathematics has fallen off about 53 percent in the past 5 years while the high-school student body has increased 16 percent and continues to go up.

The figure which I have cited of a 53 percent drop in the number of qualified math and science teachers, in reality, is a sugar-coated one, because not more than half of the men and women who leave college qualified to teach those subjects ever find their way into a high-school classroom. For example, of the 1954 college graduates qualified to teach chemistry, about 36 percent actually did so. What happened to the others? The explanation is the familiar one—better paying jobs in other lines of work.

One needs no more than these few statistics to see that our supply of scientific and technical manpower is withering at its source—in the high schools—for want of nourishment, while the Soviets assiduously cultivate ever-larger numbers at the same level.

In Russian high schools, of the study courses which every student must take 40 percent are in science and mathematics. I am told, furthermore, that young Ivan is made to work much harder than our Johnny; he goes to school 6 days a week and by the time he completes high school he has had 6 years of biology, 5 years of physics, 4 years of chemistry and 4 years of mathematics, including trigonometry. I can learn of no public high school in our country where a student obtains so thorough a preparation in science and mathematics, even if he seeks it—even if he should be a potential Einstein, Edison, Fermi or Bell.

If this were not sad enough, more than half (53 percent) of our high schools do not teach physics at all. In half of our schools students simply have no access to this subject which is so important to an understanding of the technological world in which they will spend their lives.

Half of our high schools do not teach chemistry.

Two generations ago, in 1890, 1 in every 5 high school students studied physics. Today it is only 1 out of every 22. More than half of all students back in those days studied algebra; now it is less than one-fourth. The study of chemistry has fallen off 30 percent. These are the statistics of the United States in the era of technology.

Let us look briefly at the situation that prevails in these high schools still struggling to maintain science and math courses.

A survey of 30 States showed that about 1,800 new mathematics teachers were urgently needed, but 700 of the positions had to be filled with unqualified persons, including instructors in such unrelated subjects as music, home economics, and physical culture.

I sincerely hope that none of my remarks will be regarded by anyone as reflecting upon our high-school teachers. They are devoted, underpaid and self-sacrificing people and we have too long taken advantage of their devotion. If the teacher of music, or the high-school athletic instructor, is required to teach chemistry or mathematics because no qualified instructor can be obtained, the blame should attach to us, for allowing our educational system to fall into such a regrettable state.

Also, I have dwelt on the contrasts in our educational program and its result with that of Soviet Russia, but not in any sense to suggest that what the Soviets are doing contains a solution to our problem. Their system of regimentation and even enslavement of the individual as a pawn of the state is repugnant to us.

Our solution will have to be an American solution, consonant with our traditions of freedom and the dignity of the individual.

First of all, we must in some manner insure that those students with demonstrated aptitudes receive the inspiration they deserve. This is a challenge to parents, educators, industry, professional societies and for government at the Federal, State and local levels. It should be a matter of national remorse that less than half of our brightest high-school students—those in the top 20 percent of their classes—go on to college, and only 2 percent of those judged capable of earning doctor of philosophy degrees do so. We go to great lengths to conserve our forests and wildlife and waste the most valuable asset of all.

Clearly one corrective is money. With adequate funds teachers can be fairly compensated and their numbers thus increased as they become trained and available. But where are the funds to come from? The costs of our school system are only second to those of our Defense Establishment. It is, therefore, beyond expectation that private or institutional philanthropy could step into the breach.

Does this mean the Federal Government must intervene? Many think so. They hold that a crisis is in effect upon us * * * that it is vital to our defense to have trained men not only at the controls of our complex instruments of warning and war, but especially in the laboratories whence these devices are to come, and that since these men must as a prerequisite come out of our educational system, the system itself must be federally supported if support is wanting. This is a hard argument to combat. But the consequences of Federal support are unacceptable to those of us who would like to see our educational system continue free from dependence upon Federal subsidy and from the interference and perhaps control which could follow the acceptance of such subsidy.

Many of us should be thinking of what might be done at once to begin to solve our problem. I have two proposals to advance—one immediate, the other a longer range action. Both are based upon the proposition that the public generally is unaware of the situation we face and will act intelligently, promptly and generously when it learns the facts.

For the short range I would propose that industry and the professional societies undertake through their organized bodies to popularize a plan whereby every engineer and scientist in the country would volunteer to conduct classes in physics, chemistry and mathematics in our secondary schools, for a few but certain number of hours each month during the school year. If this procedure were to be generally followed, the number of science-qualified entrants to our college system would make an appreciable change in the alarming figures now confronting us.

My second thought deals with the longer range problem, would be more difficult to organize, but might solve the problem once and for all. It is simply that the colleges should recognize the gravity of the threat we face and make a certain minimum of credits in physics and chemistry a requirement for enrollment. For instance, if such great associations as the American Council on Education, the Association of American Colleges, the Association of American Universities, and the Association of Land Grant Colleges and Universities were to consider and act favorably upon some such a proposition, we would see a great change in the curricula of the secondary schools. If their graduates had to have science to qualify for college admission, the local communities would insist that their school boards furnish it and if that meant paying a proper salary to science teachers to secure them the means would be found. It is easy to demonstrate also that the costs at the local level will be less than if the funds have to be collected through Federal taxation and then fed back to the localities with all the cost of collection and Federal administration added.

These several suggestions will surely be inferior to others that will come from educators who are more conversant with the difficulties than a layman can possibly be. I can only hope that prompt thinking and effective action will be stimulated by what is being said on this subject by Dr. Waterman, Mr. Allen Dulles, and others who have been deeply concerned by the consequences of the situation in which we suddenly find ourselves.

The extent to which science has become a major factor in our living, our environment and our fate, is something now apparent to all who will examine the facts. Our position of eminence and influence in the world has been due to the prudent and vigorous applications of technology to the development of our resources and our industrial potential. It has been built on an educational system conducted by independent communities and, until recently, healthily concerned with the cultivation of the natural sciences and mathematics along with the humanities.

If we value these possessions which have made for our eminence and influence, we must be prepared to defend them. Our greatest possession—freedom—is

itself partly the product of science, since it was technology which made slavery unprofitable, and under freedom and only under freedom all our other treasures flourish.

It is a paradox that we should find ourselves at this point in history suddenly poorer in the very means by which our greatness was achieved.

This is the cold war of the classrooms.

In 5 years our lead in the training of scientists and engineers may be wiped out, and in 10 years we could be hopelessly outstripped. Unless immediate steps are taken to correct it, a situation, already dangerous, within less than a decade could become disastrous.

CONFERRING OF DEGREES

Mr. FIELDS. You asked, Mr. Chairman, whether we give any degrees. Our approach up to this point is to conduct training in reactor technology in these schools where we have special equipment. At the same time we also have some fellowship programs which do enable students to go to universities and get degrees in these areas. The additional program initiated last year is to provide special equipment to the universities so that the training and education in these fields can take place there. It will take a year or two to do this, but it does look toward a substantial increase in the output of engineers by the universities in the years ahead.

Mr. RABAUT. Commissioner Vance, did you want to make a statement to the committee this morning?

Mr. VANCE. I think not, sir.

GERMANTOWN HEADQUARTERS

Mr. RABAUT. Mr. Evins.

Mr. EVINS. Mr. Chairman, this committee recognizes you as a great American. I am sure that we are all attempting to serve our country, that we are all trying to preserve it. I think that this committee is interested in information which as an appropriation committee we are fully entitled to have. I know you will supply us with copies of your statement so that we can consider it further.

Commissioner, what is the status of your new building out in Maryland? When do you expect to be in it?

Mr. STRAUSS. We expect to be in it in the midautumn. I think November would be a better guess than October.

Mr. DERRY. It is 73 percent completed.

Mr. EVINS. I understand you have some difficulty down there among your personnel as to whether or not the Government is to pay for transferring them out to new quarters or whether or not they are to pay for their own removal out there. What is the situation with respect to that?

Mr. STRAUSS. I would like to ask the General Manager to respond to that question.

Mr. FIELDS. I do not know of any controversy. There is the problem of operating some 25 miles out into the country. We have submitted a request for legislation to Congress which would let us provide a subsidy for transportation for a year until commercial transportation is available. Whether this will be enacted I do not know, sir.

Mr. EVINS. Are your employees willing to move out there to work at the new headquarters?

Mr. FIELDS. Obviously there are many who will not find it possible to go with us to that location, sir. This is recognized.

Mr. EVINS. In other words, to be able to get them to serve in the Commission and to move there, you are going to have to pay for their removal?

Mr. FIELDS. For permanent moves, there is existing legislation, depending on the distance of their move, under which they can be reimbursed.

Mr. EVINS. Do you have any figures in this budget for the cost of that removal?

Mr. FIELDS. It includes figures for the operation at Germantown. There is an amount in it for moving expenses; yes, sir.

Mr. EVINS. How much?

Mr. FIELDS. We have included a nonrecurring cost for the move to Germantown in the amount of $300,000, and an amount for recurring costs, which is for the continuing maintenance of the Germantown headquarters in the amount of $600,000. The $300,000 is the amount which relates to the subject you are talking about.

INCREASES IN THE BUDGET

Mr. EVINS. I notice that of the overall budget for operating expenses next year it is $2,399,727,668. In 1956, when there was the big buildup of the Atomic Energy Commission, by which we are producing bombs in great quantities, your obligations were $1.5 billion. In 1957 they were $1.8 billion. Next year for 1958, you are asking for $2,399,727,668, or an increase of more than a half billion dollars. Can you tell us in general terms why the half-billion-dollar increase? What constitutes the bulk of the increase?

Mr. FIELDS. The large increases are in the raw materials program in the amount of roughly $200 million, as the chairman indicated in his statement, and in the weapons program in the amount of $133 million. Those are the two largest increases. They result from the increased availability of material and the actual fabrication of increased numbers and types of weapons made possible by the increased production of materials which has come about as a result of plant expansions in past years.

Mr. STRAUSS. You will recall I pointed out in 1958 we will be receiving as much uranium concentrates as in the 2 preceding fiscal years.

Mr. EVINS. This is the year in which we were supposed to cut the budget.

Mr. STRAUSS. These are commitments made long ago and are firm commitments of the Government.

Mr. EVINS. You do not mean the entire half billion dollars.

Mr. STRAUSS. The larger part of it, two-hundred-some-odd-million dollars results from increase in raw material procurement.

Mr. EVINS. Are your raw materials in sufficient quantity in this country or where are they being largely procured?

Mr. STRAUSS. Canada and the United States are the largest producers at the present time. There was a period of course when we produced very, very little. We get substantial quantities of ore from the Belgian Congo, but it is a declining supply since the large mine there is being worked out. We get substantial supplies from the Union of South Africa, and small amounts, relatively insignificant amounts from Australia and Portugal.

Mr. EVINS. Uranium 235 and 238 are produced after the crude materials are obtained?

Mr. STRAUSS. What we buy is uranium oxide. That consists of 138 parts of uranium 238 and 1 part roughly of uranium 235. That one part has to be extracted in our gaseous diffusion plant.

Mr. EVINS. Through the refining process.

Mr. STRAUSS. Right.

Mr. EVINS. You spoke of the weapons program. We on the Appropriations Committee have just passed one of the largest appropriations for the Defense Department in years. One of the principal items is the intercontinental ballistic missile and the short range and long range missile. We find that the Defense Department has five separate bureaus or divisions working on the missiles. One of the biggest fights going on in the Defense Department is who is going to control the missile. How much do you have in your budget for the missile program?

Mr. STRAUSS. We have nothing in our budget for the missile program as such, sir.

(Discussion off the record.)

Mr. EVINS. Does the Department of the Air Force or the Department of the Army or the Department of the Navy each call upon you?

Mr. STRAUSS. No. Fortunately we are not subject to any difficulties of that character. The law provides a statutory committee known as the Military Liaison Committee representing the three services, which is the connection between the Atomic Energy Commission and the Department of Defense. We receive our requirements in one hand. We do not have to deal separately on a competitive basis with the services.

Mr. EVINS. We recognize you are doing a valuable service in this area. I was trying to define the possible overlapping, if any, and certainly cooperation.

Mr. STRAUSS. If there is any overlapping we would only see it from the sidelines.

(Discussion off the record.)

FELLOWSHIPS AND GRANTS TO SCHOOLS

Mr. EVINS. I have one or two other questions of a general nature in line with your grants and fellowship and scholarship program. The National Science Foundation has come before our Independent Offices Subcommittee with a large request of funds this year for the first time for grants for reactors to colleges which seems to the committee to be a direct overlapping of what your Commission is requesting. Our committee said this is a function of the Atomic Energy Commission. The Atomic Energy Commission is in this field, they are making grants. Well, we have been induced to also get in the field. So the committee did not provide funds for the National Science Foundation to make grants for equipment, leaving that to the Atomic Energy Commission. Can you not take care of the situation adequately and fully, and are you not sufficiently making adequate grants in this area without another agency of Government doing the same thing?

Mr. FIELDS. Mr. Evins, in this area, every year we have extensive conferences with the National Science Foundation. Each year this problem is reviewed. It is our feeling that the function of the National

Science Foundation, in which they concur, is to support research in broad areas, whatever they might be, Our field is limited to atomic energy matters, and our support with equipment grants and fellowships has been for education directed to the atomic energy field, including radiation and reactor engineering. If a school needs a research reactor, not because it has to do with atomic energy research, but because it contributes to research in a more general way in another area, we feel that the National Science Foundation should support it. Our support of schools is primarily to assist in education and training in the nuclear field itself as opposed to conduct of the research at the institution. I do not know whether I have made the distinction clear.

Mr. EVINS. I think I understand. You are attempting to confine yourselves to a particular area.

Mr. FIELDS. Yes.

Mr. EVINS. At the same time the National Science Foundation has a broad overall policy objective to develop science and they are making grants to teachers and colleges and now they have gone into the field, and I think a proper one, at the high-school level. So it seems to me that there is an area for overlapping to quite a degree.

Mr. FIELDS. It does take close coordination to see that it is properly handled.

Mr. STRAUSS. It would be serious, Mr. Evins, if it were not for the fact that in the persons of Dr. Alan Waterman, the Director of the Foundation, and the Director of our Division of Research, Dr. Johnson, there is the closest cooperation. They are personal friends and they see these things alike. We are not as yet, as an organization, old enough to be infected with empire building. We are not trying to expand our activities. We feel we have plenty.

Mr. EVINS. Both the Atomic Energy Commission and the National Science Foundation have large and expanded budgets for this year. I will say that to the chairman.

Mr. STRAUSS. The bulk of ours is for production.

CLEAN ATOMIC WEAPONS

Mr. EVINS. Mr. Chairman, earlier you made reference to the clean bomb that you are perfecting or have developed, which I am sure is a thing to be desired. Under your physical research you spoke of the need for funds for cleaning up the bomb. That would seem to conflict with your earlier statement which gave the impression that you already had the clean bomb with us.

Mr. STRAUSS. We have a bomb which is 95 or 96 percent clean. The scientists wish to, and we hope and believe that they will, produce a weapon which is cleaner than that.

(Discussion off the record.)

Mr. EVINS. We see much in the press, we see stories, we see cartoons about the propaganda of the clean bomb, that they are not as clean as the Atomic Energy Commission puts it out to be. What is your comment with respect to those editorials and stories and cartoons of which I am sure you are aware.

Mr. STRAUSS. I think they are irresponsible and some of them are based upon ignorance, some of them based upon good humor, some based upon malice. But ignorance is at the bottom of it.

(Discussion off the record.)

Mr. EVINS. The danger from exposure to radiation still exists and that problem has not been solved yet, either.

Mr. STRAUSS. You mean the cure of exposure to radiation?

Mr. EVINS. There might be some impression, certainly we want to limit the exposure to radiation, but some impression we had reached the stage at which there would not be great damage or great exposure.

Mr. STRAUSS. I am sure in the event of war there would be great exposure to radiation. We maintain that there is not great exposure to radiation from our tests, Mr. Evins.

AGRICULTURAL RESEARCH

Mr. EVINS. You spoke of your research in agriculture. Is there not some overlapping with the Department of Agriculture? We appropriated billions of dollars for the Department of Agriculture and their main program is for research.

Mr. STRAUSS. This is different. Our research is done in connection and in cooperation with the Department of Agriculture, but is research on the applications of radioactivity to agricultural studies. This requires the kind of equipment with which the Congress has provided the Commission with funds, and which the Department of Agriculture does not possess. We conduct this research independently and also for the Department of Agriculture. When useful results are obtained, they are published and made available to the public.

POSSIBILITY OF REDUCTIONS

Mr. EVINS. Could you tell the committee in how much of this $662 million increase the committee can with safety make a reduction?

Mr. STRAUSS. I wish you had asked me that question, Mr. Evins, before we had reduced it to bring it to you, which is ordinarily the case. We received from the component parts of the Commission an estimate of what would be required or desired, which was substantially larger than the figures which we finally presented to the Bureau of the Budget because, as is the Commission's habit, we screened them very carefully. The budget we presented is, we believe, the minimum we should ask for.

Mr. EVINS. Did the Bureau of the Budget cut your Commission down from your request to them; and, if so, how much?

Mr. STRAUSS. The Bureau of the Budget goes over it with us item by item, and various items were cut.

Mr. EVINS. How much did you ask of the Bureau of the Budget?

Mr. FIELDS. My recollection is that the reduction in this appropriation was approximately $200 million.

Mr. RABAUT. How much did you ask them for?

Mr. FIELDS. We requested $2.6 billion for operating expenses.

Mr. RABAUT. You asked for $2.6 billion for operating?

Mr. FIELDS. Yes.

Mr. RABAUT. They gave you $2.4 billion?

Mr. FIELDS. Roughly that.

Mr. EVINS. The increase is over half a billion dollars, $662,500,000. That is all, Mr. Chairman.

Mr. RABAUT. Mr. Jensen.

BACKGROUND OF AEC STAFF

Mr. JENSEN. Admiral Strauss, I am always intrigued by the great knowledge that you and your fine staff have of the whole atomic energy program. I am not a scientist but I do enjoy getting a sort of liberal education on the atomic energy program by sitting here and listening to you and the staff.

I think it would be very proper to have each member of the Commission staff that is here today, numbering about 25, which I presume are your top scientists and engineers and metallurgists and the heads of every branch of your Commission, to just stand up and tell us who they are and what their job is.

Mr. STRAUSS. I will be glad to do that. I think it is the brightest group of men in government.

Mr. JENSEN. I think you are right, and on the shoulders of you gentlemen rests the security of America. There is no question about that. I think the general public would like to know the names and the duties of the head of each one of your branches of the Commission.

Mr. RABAUT. If there is no objection to that, we will proceed with that.

Mr. JENSEN. It will only take a minute to do that.

Mr. STRAUSS. I would like to say, Mr. Jensen, I do not like to advertise these gentlemen, because they are always being fished for.

Mr. JENSEN. Maybe there is something to that.

Mr. RABAUT. I think anybody would know where they would be. The committee wants to be on the floor at noon today. We have only 3 minutes, so we will do that this afternoon.

1957 UNOBLIGATED BALANCES

Mr. JENSEN. I have 1 or 2 more questions to ask.

Mr. Strauss, what is the amount of your unobligated funds which we appropriated for fiscal 1957 which you now have available?

Mr. MCCARTHY. The unobligated balance, Mr. Jensen, at the end of 1957, in this appropriation, amounts to $53,100,000.

Mr. JENSEN. Of course, you have a lot of money that has not been expended, but this is the amount that you have not obligated.

Mr. MCCARTHY. That is correct.

Mr. JENSEN. As of July 1.

Mr. MCCARTHY. July 1.

DESCRIPTION OF A PROTOTYPE

Mr. JENSEN. Would you explain the difference between prototype weapons and other weapons in just a few words?

Mr. STRAUSS. I think very simply the prototype weapon is the first of its kind, that is all. It is the first one of its species. The man who made the first Garand rifle and brought it into the Defense Department had a prototype weapon in his hand.

Mr. JENSEN. So it is the first like the Indians were the first here.

Mr. STRAUSS. They were proto-Americans.

AVAILABILITY OF SCIENTISTS

Mr. JENSEN. Now, I think it was 3 years ago when we discussed this problem of getting more scientists and engineers and students

that would take an active part and would school themselves in the art of science. I think you wrote letters. I think that I suggested you write letters to these universities and colleges and encourage the instructors in these particular studies to encourage their students to take up these studies which are so necessary in the sciences. What has been the result of that?

Mr. STRAUSS. It is too early I think to measure the result, if indeed there has been one. In the interval I have had some surveys made, others have made them, which have indicated, Mr. Jensen, that the deficiency is not in the colleges. The colleges do not get the human material in sufficient numbers from the secondary schools. The attempt has been made and is being made on a very wide front to provide science instruction on a more widespread basis in the secondary schools. A large percentage of them do not have it at all.

Mr. FIELDS. Mr. Jensen, following last year's discussion in which you raised this same question, we did move forward on this project and we had 59 high-school teachers in for short courses. In 1958, we are requesting some additional money so that in 1958 we will have $320,000 to stimulate teachers, and by that means stimulate students.

Mr. JENSEN. I am glad to hear that. I think that possibly is the best and the quickest way and possibly the cheapest way to get students interested in this great work.

PROGRESS IN RUSSIA

Now, I do not know whether you want to say this on the record or off the record, but when you hear so much about the countries back of the Iron Curtain being ahead of us in atomic experiments and everything pertaining to the atomic bomb what is the true story? I am sure that you folks have the answer.

Mr. STRAUSS. Mr. Jensen, it will depend really on what observer you ask. It is like asking the blind man about the elephant. If a man is interested in high energy physics and regards that as the be all and end all, because it is his primary concern, there is no doubt of the fact that the Russians are at the present time expending a great deal of effort on large and expensive accelerators. We think from what we have been able to learn about them that they are copies and large copies of our most advanced work.

Mr. JENSEN. You say you think?

Mr. STRAUSS. Obviously it has to be based on a certain amount of deduction, because you are not allowed in to look. We think that if they were anywhere near us with respect to power that they would demonstrate it for the propaganda benefit that they would gain from it. They had no hesitation in showing a reactor at Geneva in the summer of 1955 which—compared with what we had then on the *Nautilus*—was a model T Ford by comparison. And I do not believe that they are anywhere near the position that we are in the development of atomic energy.

Now, events could prove me to be wrong, but I say this out of sincere conviction.

PUBLICITY ON FALLOUT

Mr. JENSEN. We have been talking a lot about fallout. You made a very fine explanation of that problem. Of course, you know you

have all kinds of experts in the newspaper field on atomic energy, but I find that most of those so-called professed experts are free lance writers. They are not connected with a responsible publication. I do not take much stock in them or cartoons or do I believe that the American people do, but it creates a feeling of uneasiness.

Now, I think a clear concise statement by your Commission regarding that question, released to the newspapers, as you explained it to Mr. Evins this morning, would be a great consolation to the American people, because certainly the great majority of the American people will take your word, backed up by the Commission, to a far greater degree than they would take some of these self-appointed experts on atomic energy and the fallout question. So I would recommend it, I know you have done it to some degree, but I think that you cannot say too much about it.

I think you can assure the American people that you have a bomb that is almost 100 percent clean, and you are working on a cleaner bomb, and that you are making progress, and that in due time you hope to have a completely clean bomb.

Mr. STRAUSS. Mr. Jensen, I wish it were true that something I would say would have some credence and some circulation.

Mr. JENSEN. It certainly does. You have been criticized of course by the professionals.

Mr. STRAUSS. Let me tell you what has happened. You may perhaps be able to provide the answer to it. It is a very interesting phenomenon. In the spring of last year, on April 25, the President of the United States had a press conference, and he made a statement in which he said that tests were about to start, or that the tests which had just started had two main purposes. One was to produce weapons for defensive use, and the other was to see whether we could produce weapons with decreased radioactive fallout.

When the tests ended in July, I made a statement for the Commission referring to the fact that the President had made these two observations and saying that the tests were successful in both directions. I repeated that statement 10 days later. The Commission issued it to the press. On the 6th of October, the President again referred to the clean weapons that had been successfully demonstrated in the tests that spring, and said that further work was being conducted with the expectation that improved results would occur. On the 24th of October he said it again. On the 5th of June he had a press conference. In answer to a question, he said:

> The Chairman of the Atomic Energy Commission assures me it is now possible to make atomic weapons in which the radioactive fallout is reduced by nine-tenths.

None of this got any attention. About 10 days ago or 2 weeks ago these 3 scientists were here. Mr. Cole suggested they ought to see the President. An appointment was made. The President asked me to be there. We went outside the White House afterward and said these same things to the press, and that got all over the front pages as though it was something brand new.

Now, I cannot understand it. There are gentlemen here, who, if they had identified themselves to you, would have identified themselves as experts in communication. They are Mr. Salisbury and Mr. Holles. They cannot tell you why that is.

I just received this morning a letter from Ernest Lawrence. Dr. Ernest Lawrence is a Nobel laureate, head of the Radiation Laboratory at Berkeley. He sends me a paper written by Dr. John Goffman. He describes him as an extraordinarily brilliant man who received his doctor of philosophy degree in nuclear chemistry at the University of California. Here is one paragraph:

> Careful studies, for example, of natural radiation levels have shown from one geographic area to another natural radiation levels differ with each other by quantities that are huge compared to fallout.

That is to say, the difference between living at sea level and the difference between living at Denver is far greater from the point of view of the amount of radiation you receive than from fallout.

Mr. RABAUT. At which place?

Mr. STRAUSS. The normal radiation you receive at sea level or some place a few hundred feet above is lower than that which you receive at higher altitudes.

In Sweden, for example, careful studies have shown that people inside brick buildings and certain types of concrete buildings receive 2 or 3 times more radiation than do people inside wooden buildings, due to the radioactive substances in brick and concrete. It is also known that the luminous dial of a wristwatch delivers more radiation by something like a factor of 2 than all that received from the accumulated fallout to date. A campaign, if one is inclined to campaign, against luminous wristwatch dials would with the above assumption be more beneficial to humanity.

Here is a scientific fact. It will never get printed except in the record of this hearing.

Mr. JENSEN. You have on your staff experts who are studying this radioactive fallout, do you not?

Mr. STRAUSS. Yes, sir.

Mr. JENSEN. I am just wondering if a release through you, written by those experts, would not explain this question. Would it not be the thing that the people might tag to? You have been criticized from Hades to breakfast, but here come your experts in that field and they make a statement. Now, I just believe that would hit the headlines and it would possibly get more credence than if Admiral Strauss said it. So think about that. We have great regard for you, and the fate of America rests on the shoulders of you gentlemen. Every single one of you could go out and get more pay from private industry than you are getting from Uncle Sam, but you are devoted people and we just wish you Godspeed in the great work you are doing.

Mr. STRAUSS. Thank you, Mr. Jensen.

Mr. RABAUT. The committee will adjourn until 2 o'clock.

AFTERNOON SESSION

Mr. RABAUT. The committee will come to order.

Now, I recognize Mr. Andersen.

AVAILABILITY OF SCIENTISTS

Mr. ANDERSEN. Admiral, I was much interested in your problem of finding scientists with which to do a job. Of course we are faced with that same problem in many categories of government. I attended

a meeting of the Soil Conservation Society of America in Tulsa, Okla., last fall, and it was brought up there that the main difficulty nowadays is the securing of qualified engineers. Now you are faced with that same problem and as far as I can see ahead in my judgment you will be faced with that for a good many years to come. As you well stated, it is becoming more difficult to secure the raw material from the secondary schools for the training of the scientists that we as a nation do need.

Now, you mentioned something, I believe, sir, about some 25 universities receiving grants, did you not?

Mr. STRAUSS. I think the General Manager testified to that.

Mr. FIELDS. The correct figure is 34.

Mr. ANDERSEN. Now, in relation to those particular 34, who are able, as I understand it, to put up certain qualified courses of study, do you have among them 1 or 2 perhaps like MIT, which are qualified or have the ability to produce real top scientists for your work?

Mr. STRAUSS. I think the answer to that would be this. They are all qualified to produce top scientists and the size or prominence of the institution apparently has very little to do with the product. There is a small college, for example, on the Pacific coast, Reed College, of which few people outside of academic circles have ever heard, which has a higher percentage of doctors of philosophy among its graduates than any other college, or did a few years ago. So that size is not the criterion.

Mr. ANDERSEN. That naturally would not be in this case. Through the years you might say as a half-baked engineer in my own right, I have a great respect for MIT. In fact, quite a few years back I came close to matriculating from there. That just came across my mind the question as to how well qualified are these scientists who do graduate from the institutions for the work you have for them when they join up with you. Does your school further indoctrinate them?

Mr. STRAUSS. I think perhaps you are under a misapprehension that we are concerned only with the training of scientists for employment with the Commission. That is a minor aspect of the problem. The major concern is the overall shortage—the great needs of private industry for nuclear physicists, the nuclear physicists and engineers who will be required to staff the institutions in which we will have an interest abroad, and if, God willing, there is a disarmament agreement, which will require elaborate inspection procedures with a large staff, we will want to have very competent men engaged in that and great numbers of them will be needed. For these reasons the shortage exists, sir. But to specifically answer your question, I think that the men who are finishing these courses are generally qualified for the work into which they are going.

Mr. ANDERSEN. That is all, Mr. Chairman.

BACKGROUND OF AEC WITNESSES

Mr. RABAUT. Mr. Jensen.

Mr. JENSEN. Admiral, just before we adjourned for lunch I had made a request that each member of your Commission staff present rise and give his name and branch of the agency in which he serves. I think he should at the same time give us a short history of his schooling, his experience and so on, verbally. Now, we generally ask that

of every agency head, and those who are in policymaking positions in the Government. I think it is good and the chairman agrees with me. So if you will do that, Admiral, and ask each member—you have one of your cocommissioners here. He will start and then your General Manager and down the line.

Mr. STRAUSS. I am going to ask my colleague, Mr. Vance, to qualify himself. I know he needs no introduction to you. Then I shall ask, with your permission, the General Manager to introduce the various members of the staff who are here.

Mr. JENSEN. All right.

Mr. VANCE. I am just a Commissioner, sir.

Mr. STRAUSS. Let me amplify that. Mr. Vance is a very distinguished businessman. He was president and chairman of the board of the Studebaker Co. Prior to that he was in a responsible position with Packard. During the war he served on a number of important committees, working with the War Production Board during the Korean war. He was chairman of the committee investigating procurement practices for the Department of Defense. I had the honor of serving as a member of his committee. I saw him operate as chairman. He has a long and distinguished list of honors. I shall not embarrass him by reciting them here.

I turn the introductions over to General Fields, about whom I might also say a word. General Fields comes to us as General Manager after a long period of service in the Corps of Engineers, and after having been the Director of our Division of Military Application. He is a graduate of West Point. He operates a taut ship and happy ship in the Atomic Energy Commission. The Commissioners consider themselves extremely fortunate to have been able to persuade him to leave the service to which he had dedicated himself, with the consent of the President, to join us in a civilian capacity.

He is a recipient of the Distinguished Service Medal and other awards from an appreciative and grateful Government.

Mr. FIELDS. Thank you, Mr. Chairman.

I will just briefly introduce the various members of staff.

Mr. Tammaro is the Assistant General Manager for Research and Industrial Development.

Mr. TAMMARO. I am an MIT graduate. I spent the last 14 years of my life in the field of atomic energy right from the start of the wartime project to date, mostly in research and development.

Mr. FIELDS. Mr. Diamond, who is Acting General Counsel.

Mr. DIAMOND. I am a graduate of Brooklyn Law School and have been a member of the New York Bar for 25 years, also am a member of the Tennessee Bar, with the Manhattan District at its beginning in 1942, and have been with the Commission ever since.

Mr. FIELDS. Mr. Burrows, our Controller.

Mr. BURROWS. I am a graduate of the University of California, and have been with the Government for over 20 years including more than 4 years with the Atomic Energy Commission.

Mr. FIELDS. Mr. Johnson, Director of Raw Materials.

Mr. JOHNSON. I am a mining engineer, a graduate of the University of Washington, and came with the Government for the first time in 1943 for temporary duty during the war. I was with the RFC and joined the Atomic Energy Commission in 1948.

Mr. FIELDS. Mr. Bloch, Director of the Production Division.

Mr. BLOCH. I studied engineering at Washington University in St. Louis. I have been with the program since the Manhattan District days. I was assigned there as an officer of the Corps of Engineers in 1943.

Mr. FIELDS. Mr. Davis, Director of Reactor Development Division.

Dr. DAVIS. I am a chemical engineer from the University of California and MIT, worked in the oil business, was professor of engineering at the University of California. I have been with the Commission about 3 years, and in the atomic energy business about 6 years.

Mr. FIELDS. General Starbird, Director of Military Applications.

General STARBIRD. I am a graduate of the Military Academy, class of 1933, and I have been an engineer in the corps ever since, also a graduate of Princeton, civil engineer, in 1936. I joined the Commission 2 years ago this month.

Mr. FIELDS. Dr. Johnson, Director of Research.

Dr. JOHNSON. I am a research physicist from Yale. I worked in basic research practically all my life until the war. I was with the Army Ordnance Corps for 5 years, finally as Associate Technical Research Director of the Physics Research Laboratory at Aberdeen. I served 4 years with the Physics Division in Brookhaven National Laboratory and came to the Division of Research as Director about 5½ years ago.

Mr. FIELDS. Dr. Dunham, Director of the Division of Biology and Medicine.

Dr. DUNHAM. I am a physician and served as Director of Rush Medical College of Chicago University. I was on the staff of the medical school doing research until 1949. Spent a few years in the armed services, came with the Division of Biology and Medicine in 1949, and have been with the Commission ever since.

Mr. FIELDS. Mr. Salisbury.

Mr. SALISBURY. I am a graduate of Kansas State College and graduate student of the University of Wisconsin and was Director of Information successively, in the Department of Agriculture, the United Nations Relief and Rehabilitation Administration, for the Committee for Economic Development, Deputy Secretary General of the International Emergency Food Administration, and with the Commission since 1947.

Mr. FIELDS. Captain Gardner, head of the Office of Special Projects.

Mr. GARDNER. I am a graduate of the Naval Academy and am a retired captain in the Navy, and holds a master's degree in business administration from American University.

Mr. FIELDS. Mr. Derry, Director of Engineering and Construction.

Mr. DERRY. I am a graduate of Raoul Poletechnic Institute in Indiana; worked with the Pennsylvania Railroad through the electrification days; was with the Electrification Administration at the start of that. I served with the Manhattan District from 1942 and have been with the Commission ever since. I hold a Commission in the Reserve as professional engineer.

Mr. FIELDS. Mr. Smith, Director of Organization and Personnel.

Mr. SMITH. I am a graduate of Antioch College, in Ohio, have spent 7 years in private engineering construction and 23 in Government, including the last 10 with AEC.

Mr. FIELDS. Mr. Towne, in charge of community operations in the Division of Production.

Mr. TOWNE. I am a graduate of the University of Massachusetts in 1923, and have been in the Federal service in community planning and development, the last 9 years of which have been with the Commission.

Mr. FIELDS. Mr. LaPlante, assistant to the General Manager for Congressional Relations.

Mr. LAPLANTE. I attended Washington University and St. Louis University, majoring in law and economics, and joined the Manhattan District in 1945 as security intelligence officer to General Groves, then transferred to the Atomic Energy Commission and have been with it since its inception.

Mr. FIELDS. Mr. Holles, assistant to the Chairman.

Mr. HOLLES. I attended Michigan State and Harvard, engaged in newspaper work, radio, wire services during that time. I joined the Commission and became assistant to the Chairman 3 years ago.

Mr. FIELDS. Mr. Bodley, assistant to Commissioner Vance.

Mr. BODLEY. I am a graduate of Vanderbilt University and Vanderbilt University Law School; member of the Tennessee bar. My experience includes 1 year as law clerk to Hon. John D. Martin, United States circuit judge, Sixth Circuit Court of Appeals, and 4 years as trial attorney in the Antitrust Division of the United States Department of Justice. I came with the AEC as assistant to Commissioners Libby and Vance in December 1956.

Mr. EVINS. Mr. Chairman, I am glad that the Commission has such an excellent legal staff, a member of the Tennessee bar and graduate of Vanderbilt.

Mr. FIELDS. Dr. Edwards, Assistant Director for Technical Programs, Division of International Affairs.

Dr. EDWARDS. I am a research chemist, a graduate of MIT, and joined the atomic energy program in 1943 at Oak Ridge. I have been with it one way or another ever since. For the last 8 years I have been with the chemistry department of the University of Arkansas as chairman, from which position I am now on leave.

Mr. FIELDS. Dr. Potts, assistant to Commissioner Libby.

Mr. POTTS. I am a physical chemist from the University of California with some years of industrial experience. I have been in atomic energy work since 1948.

Mr. FIELDS. Mr. Miller.

Mr. MILLER. I am the Deputy Assistant Controller for Budgets. I attended the University of Pennsylvania and American University and spent about 6 years in private industry, primarily in the accounting field and 6 years as fiscal director of the city of Reading, Pa. I have had 16 years of employment in the Federal Government, 6 years of which were with the Bureau of the Budget and approximately 8 years with the Atomic Energy Commission.

Mr. FIELDS. I saved this fellow for last, because he is the secret, if we have any, of our success with you, sir. He really prepares our budgets. He prepares it so that you can understand it, I hope. He is our Assistant Controller for Budgets, Mr. McCarthy, who has appeared before you for many years.

Mr. MCCARTHY. I have been with the Government since 1930, with the Government Printing Office, the Treasury Department, and the Bureau of the Budget. In 1942 I became assistant to the budget officer for the War Department and served throughout the war

period. When the funds for the Manhattan district were transferred from the War Department to the Atomic Energy Commission in 1947, I went with them, and have been with the Commission since its inception.

Mr. STRAUSS. You can see why I am proud to be associated with these men. I am the only man in the group who does not have an earned college degree. I went to work at 16.

Mr. JENSEN. Now, Admiral, I can understand why you are proud of your staff.

Mr. STRAUSS. It is a group that it is great to work with.

Mr. JENSEN. They are a fine group of men who are dedicated to this great task before you. Now, you graduated from the college of hard knocks.

Mr. STRAUSS. I am still entered.

Mr. JENSEN. Would you tell us your experience, your past experience?

Mr. STRAUSS. They are brief. Like Harry Byrd, I am a Virginian. I was born in West Virginia as he was. I was raised in Richmond, Va., in the public schools. I became private secretary to Herbert Hoover in 1917 and had a short tour of duty in the Army in 1917. I went to work for a banking firm in New York, became a partner and later a senior partner. I entered the Naval Reserve in the early twenties and was called to active duty in March 1941. I served through May of 1946, being promoted through the several grades to flag rank. I was appointed to the Atomic Energy Commission by President Truman in 1946 and resigned from my business and boards that year. I served until 1950 and then resigned and retired from business. I was invited by Mr. Rockefeller and his sons to become adviser and counsel to them. I served with them from 1950 through the spring of 1953, and was invited by President Eisenhower to come to Washington as his adviser on atomic affairs. I was appointed to the Commission as Chairman in July of 1953, and am serving a term which expires June 30, 1958.

Mr. JENSEN. How many honorary degrees do you have?

Mr. STRAUSS. At last count, I think there were about 25. But my son says you have to have a hundred of them to equal one earned degree, so I am still a long way from par.

Mr. JENSEN. Well, you know, I think every good American would like to read this record that you folks just made today and to know the kind of people that are on the Commission and the staff.

Mr. STRAUSS. I think, Mr. Jensen, as long as you are on this very interesting subject of background, I should mention that Dr. Libby, who is not here, who is abroad, and is receiving an honorary degree from the University of Dublin, is the holder of many earned degrees, a man of great distinction in the scientific world for having done quite extraordinary original work. The two appointees to the Commission whose confirmation has not yet passed the Senate are also men distinguished in their fields. Mr. Floberg is a lawyer from Chicago who had a distinguished career in the Navy during the war in service. He had a gallant career as a commander of small craft in the Pacific. He later served as Assistant Secretary of the Navy, and was in charge of that part of the Naval Establishment in which the Office of Naval Research is domiciled, and was greatly interested and occupied with the construction of the *Nautilus*.

Mr. John Graham, a native of Massachusetts by birth, but a North Carolinian, served in the Navy first as an enlisted man, later as an officer, and was appointed Assistant Secretary of the Treasury during the closing years of the last administration and had much to do with straightening out the affairs of the Bureau of Internal Revenue when it got into some difficulties in the last months of that period. In addition to these men, there are members of the staff who are not present, laboratory directors, and heads of offices whose backgrounds are not less impressive than those of the men who are here. It should not appear by oversight or by the fact that they are not here that this is all of the galaxy. It is an important part of it, but it is by no means all of it.

Mr. JENSEN. Thank you, very much. That is very interesting. That is all, Mr. Chairman.

URANIUM RESERVES

Mr. RABAUT. Mr. Taber.

Mr. TABER. I have one or two questions. How near are you approaching the reserves that you think we should have in connection with our atomic activities?

(Discussion off the record.)

OPERATION OF SHIPPINGPORT REACTOR

Mr. TABER. Is the Shippingport reactor near Pittsburgh in operation yet?

Mr. STRAUSS. No, sir. It is expected to be in operation late this year.

Mr. TABER. How much uranium would be used in operating a plant like that?

Mr. STRAUSS. Only a very small part of its load is actually consumed. What is the percentage, Dr. Davis, of the core of the Shippingport plant that would be burned before a new core is installed?

Dr. DAVIS. It would be several percent of the material in the reactor which would be burned before a new core would be put in. In this particular case, the core is divided into two sections. One of these is highly enriched and the other is natural uranium. The intent would be to burn up the enriched material to the extent of perhaps 20 or 25 percent before it would be returned for reprocessing and refabrication. The natural material would be left in until it might have had a burnup of a fraction of a percent.

Mr. STRAUSS. Would you want to say what the proportion of the enriched and natural is?

Dr. DAVIS. There are roughly 12 tons of natural uranium and about 75 kilograms of enriched material.

Mr. STRAUSS. That is 150 pounds of enriched material, roughly, and 12 tons natural.

Mr. TABER. How does that compare with the cost of other fuel? I am not going into the cost of the reactor itself, because that is an experimental matter yet. But how does that compare as far as fuel goes in cost with the amount that would be required to accomplish practically similar purposes?

Dr. DAVIS. In a reactor of the Shippingport type where as you are burning up the U–235, you are making some plutonium, and then

burning part of this plutonium, the net cost of the material burned is substantially less than the cost of an equivalent amount of coal or oil. But this is disregarding the cost of fabricating the fuel element and doing the reprocessing.

Mr. TABER. That to this date is practically an experimental production?

Dr. DAVIS. It is in an experimental state certainly.

Mr. TABER. That means that it costs a lot more money than a normal item in volume production.

Dr. DAVIS. Yes, sir. The first time you do any of these things, it is going to be expensive.

Mr. RABAUT. Mr. Fenton.

Mr. FENTON. Mr. Chairman, I just want to say that over the years I have listened to a great deal of the discussion of this atomic energy program on the floor of the House, and in the press and so forth. This is the first opportunity I have had to listen to the details by people who really do know the subject. I presume, Mr. Chairman, you are going to proceed with the hearings as you have heretofore, and go into it item by item. So as we go along, I will have some questions to ask at that time. I am particularly interested in your biological and medical research work. I hope to try to derive some benefit out of that.

Mr. STRAUSS. Thank you.

RAW MATERIALS PROGRAM

Mr. RABAUT. Now we will take up the raw materials section of this. That is on page 13. We will put pages 13 through 22 in the record. It is my understanding that the amounts appearing on the pages we will be inserting in the record during these hearings may differ from the budget as transmitted to the Congress in January. This comes about by the fact that since that time a further review of the fiscal year 1957 programs has resulted in a revision to some of the fiscal year 1957 amounts. Also, there have been some changes in the fiscal year 1958 estimates which have not yet been officially transmitted to the Congress.

(The justification follows:)

RAW MATERIALS PROGRAM—OPERATING COSTS

Program statement

Estimate, fiscal year 1958	$599,000,000
Estimate, fiscal year 1957	406,663,000
Increase	192,337,000

Uranium concentrate procurement in fiscal year 1958 is estimated to be 27,400 tons as compared with estimated fiscal year 1957 procurement of 16,268 tons. This procurement, together with other raw-materials procurement, is budgeted in fiscal year 1958 at $590,985,000 which represents 98 percent of the total cost of the raw-materials program. Uranium concentrate costs comprise 93 percent of the total program costs. The average price per pound of uranium concentrates from all sources is estimated to be moderately lower in fiscal year 1958 than in fiscal year 1957.

Fiscal year 1958 tonnage from domestic sources is expected to increase 39 percent and from Canada 242 percent over fiscal year 1957, with procurement from overseas sources expected to remain at approximately the same level.

Although the greater part of the total cost of $599 million budgeted for the raw materials program in fiscal year 1958 will be incurred for uranium-concentrate procurement, funds will also be needed for the procurement of uranium ores,

vanadium, thorium, and other source materials. The Commission will continue to acquire at published prices domestic uranium ores offered which meet specifications. The Commission is committed under certain older procurement contracts to purchase all vanadium pentoxide generated as a byproduct of uranium concentrate production which the contractor desires to sell. These AEC commitments represent, in effect, any vanadium produced in excess of commercial demand. Due to the vanadium goal of the national stockpile of strategic materials having been reached, recent contracts provide for the contractor being reimbursed for the vanadium contained in the mill tailings, title to which remains with the Commission. Thorium is a material with potential uses in the power-reactor field which is procured under a Commission stockpile-goal authorization.

The exploration program supports the uranium-ore and concentrate-procurement programs and is budgeted at a lower level in fiscal year 1958 than in fiscal year 1957. This is due to the expected continuation of private exploration in the United States at its present substantial level. The domestic program will be designed to obtain the ore reserve information on private mining and development operations which is required for administration of the procurement program, and to carry out a long-range geologic study and evaluation of uranium resources. The foreign exploration program will include the furnishing of preliminary technical assistance to foreign countries, followed in some instances by cooperative exploration projects.

The second supporting program, process development, is budgeted for fiscal year 1958 at a lower level than in fiscal year 1957. Process development seeks to improve and develop methods for extracting uranium from existing and new sources of ore, some of which offer substantial treatment problems. This program has materially reduced production costs and improved recoveries in existing mills and enabled the negotiation of lower concentrate prices with new mills.

Summary of estimates by category

Category	Actual fiscal year 1956	Estimate fiscal year 1957	Estimate fiscal year 1958
1. Exploration	$9,420,364	$7,466,000	$5,072,000
2. Procurement of source materials	267,394,757	395,620,000	590,985,000
3. Process development	3,417,326	3,116,000	2,250,000
4. Equipment not included in construction projects	813,507	461,000	693,000
Total, raw materials program	281,045,954	406,663,000	599,000,000

JUSTIFICATION OF CATEGORIES

1. Exploration, $5,072,000

(a) United States, $4,762,000.—With the expansion of private exploration in the United States, AEC's domestic exploration program will be concentrated on geologic investigations and surveys designed to provide information on existing and potential uranium resources and on the evaluation and development of improved exploration techniques. To insure an adequate and continuing ore supply and to assist in the appraisal of domestic uranium resources and aid production planning, private discoveries of uranium-bearing ores will be examined and their probable potential evaluated.

A breakdown of the estimates for fiscal years 1957 and 1958 into major functional categories follows:

	Fiscal year 1957	Fiscal year 1958
Geologic investigations	$3,989,500	$2,672,500
Ore reserves evaluation	683,000	617,000
Research and supporting services	2,533,500	1,472,500
Total, United States exploration	7,206,000	4,762,000

(*b*) *Foreign, $310,000.*—The entire foreign exploration program falls into the "geologic investigations" category. Estimates for fiscal years 1957 and 1958 are shown in tabular form below:

	Fiscal year 1957	Fiscal year 1958
Brazil	$90,000	$100,000
Other foreign countries	80,000	60,000
Technical personnel in foreign countries	90,000	150,000
Total, foreign exploration	260,000	310,000

The last item provides for preliminary reconnaissance by AEC technical personnel in a number of foreign countries. Subsequently, AEC personnel would be assigned to those countries with favorable prospects to participate in the carrying out of cooperative exploration projects with the governments of those countries. In fiscal year 1958 it is expected that AEC personnel will be stationed in Peru, Chile, and several other countries throughout the world. United States Geological Survey personnel will continue to be stationed in Brazil.

2. Procurement of source materials, $590,985,000

(*a*) *Uranium concentrates and oxide, $560,114,000.*—Requirements for uranium concentrates are directly related to the amount of uranium feed needed by existing gaseous diffusion plants and reactors to produce the fissionable materials required for weapons production, reactor development, and research purposes.

The Commission is committed under existing domestic and foreign unit price contracts and agreements with foreign governments to purchase all uranium offered in any given year, subject only to the overall commitment based on the various contract periods. Thus, uranium concentrate procurement costs, which represent the major portion of total costs budgeted, constitute a firm obligation of the Commission.

The aggregate quantity of U_3O_8 budgeted for fiscal year is 27,400 tons, 81 percent of which is United States and Canadian production. The largest production increase is expected to occur in Canada. Four additional processing mills will begin producing in fiscal year 1957 and 13 additional mills will enter production in fiscal year 1958, bringing the total number of Canadian mills to 21 in fiscal year 1958, which will more than triple production estimates for fiscal year 1957. Additional production from 12 new mills in the United States, 4 of which will begin production in fiscal year 1957 and the others in fiscal year 1958, together with increased production from present domestic mills, will increase estimated production by almost 40 percent over fiscal year 1957.

Costs of uranium concentrate procurement from the United States, Canada, and from overseas sources for fiscal years 1957 and 1958 are set forth below:

	Fiscal year 1957	Fiscal year 1958
United States	$159,262,000	$206,887,000
Canada	76,276,000	245,875,000
Overseas	120,475,000	117,550,000
Total, uranium concentrates	356,013,000	570,312,000
Less sale of uranium ores to processing contractors	9,428,000	10,198,000
Uranium concentrates costs, net	346,585,000	560,114,000

(*b*) *Uranium ores (net), $3,198,000.*—The Commission is committed to purchase at published prices ores offered which meet specifications. The Government ore procurement program reached its peak in fiscal year 1956, with ore purchases and costs estimated to decrease in fiscal years 1957 and 1958 since new-industry-owned and -operated processing mills producing in both years will obtain most or all of their ores directly from their own or other private mines. Estimates are based on ore reserve data, development and production plans of mine operators, past experience at ore-buying stations, and on planned new processing mills and mill expansions. A portion of these purchased ores is fed to process at the Commission-owned mill at Monticello, Utah. Budgeted ore procurement and usage at Monticello are shown in the following table:

	Fiscal year 1957			Fiscal year 1958		
	Tons of ore	Price per ton	Cost	Tons of ore	Price per ton	Cost
Ores purchased	627,000	$32.42	$20,325,000	396,000	$28.52	$11,295,000
Less—usage of ores	177,000	36.44	6,449,000	234,000	34.60	8,097,000
Total, uranium ores (net)	450,000	30.84	13,876,000	162,000	19.74	3,198,000

The unit price decrease for ores purchased and used at Monticello results from anticipated lower-grade ores being received from the mines.

(c) *Bonus incentive for initial ore production, $2,000,000.*—Under the terms of AEC's domestic uranium program circular 6 a bonus is paid for the initial 10,000 pounds of U_3O_8 contained in ores delivered from an eligible uranium mine to a buying station or processing mill. To May 31, 1957, 915 mines had been certified as eligible and the full benefit payments allowed had been paid to 200 of those mines. Bonus payments are estimated to be $3,109,000 in fiscal year 1957.

(d) *Vanadium, $2,494,000.*—Certain unit price domestic uranium concentrate contractors have the option of disposing of the byproduct vanadium pentoxide either on the open market or to the Commission at a fixed contractual price per pound. No AEC purchases of pentoxide were made in fiscal year 1956, all sales of contractor production being made to industry, and it is assumed that no purchases will be made by AEC in fiscal years 1957 and 1958. This contingent liability is a contractual commitment of the Commission and should the market fail to absorb all vanadium pentoxide production, it would result in additional AEC costs of up to an estimated $9,536,000 in fiscal year 1958.

Recent uranium procurement contracts provide for the Commission reimbursing the contractor for the vanadium contained in the mill tailings, from which the vanadium may be extracted later if needed, rather than committing the Commission to purchase all vanadium pentoxide delivered by the contractor. This development is primarily due to the national stockpile goal for vanadium having been reached. The vanadium-bearing tailings are stored in Commission-owned stockpiles. The price per pound of vanadium contained in tailings is $0.31 rather than the contractual price of $0.98+ per pound for vanadium pentoxide. The tailings estimates are based on the average-grade vanadium contained in ores available to each plant.

Tonnage and costs in fiscal years 1957 and 1958 are estimated to be as follows:

	Fiscal year 1957			Fiscal year 1958		
	Tons V_2O_5	Unit price (per pound)	Cost	Tons V_2O_5	Unit price (per pound)	Cost
In tailings	3,400	$0.31	$2,133,000	4,023	$0.31	$2,494,000

(c) *Thorium, $3,471,000.*—The AEC-owned thorium stockpile goal is 2,500 tons of contained thorium metal. The Commission is committed under unit price contracts for the acquisition shown hereunder.

Thorium procurement in fiscal years 1957 and 1958 is programed as follows:

	Fiscal year 1957			Fiscal year 1958		
	Metal tons	Unit price (per pound)	Cost	Metal tons	Unit price (per pound)	Cost
United States	338	$5.18	$3,500,000	140	$4.82	$1,350,000
Foreign	227	5.45	2,475,000	191	5.55	2,121,000
Total acquisition	565	5.28	5,975,000	331	5.24	3,471,000

The AEC-owned thorium metal content inventory position as of June 30, 1958, after taking the above fiscal year acquisitions into account, is expected to be:

	Tons
Inventory as of June 30, 1956	1,244
Acquisition in fiscal year 1957	565
Acquisition in fiscal year 1958	331
Total inventory as of June 30, 1958	2,140

(*f*) *Other source materials, $19,708,000.*—This activity provides for the procurement of other source materials required in the Commission's production program. Additional information of a classified nature is presented on page 24.

3. Process development, $2,250,000

Costs under this category will be incurred for the improvement of existing uranium-extraction processes in order to increase U_3O_8 recovery and for the development of processes for the recovery of U_3O_8 from new sources. In the past, metallurgical improvements have been due almost entirely to the process development and pilot plant work conducted by the Commission. The Commission has taken advantage of the process improvements developed by negotiating lower concentrate prices with new mills. This type of work will continue to be emphasized in fiscal year 1958 because of the substantial savings realized to date for a relatively small investment by the Commission. Other work without as direct an application to present and planned uranium production facilities will be at a somewhat lower level than in fiscal year 1957. The laboratory phase of the work on developing a satisfactory process for the extraction of uranium from shales will be completed in fiscal year 1958.

The general types of process development effort planned in fiscal years 1957 and 1958 are:

	Fiscal year 1957	Fiscal year 1958
Raw Materials Development Laboratory (principally domestic ores)	$2,000,000	$2,000,000
Other contractors (domestic ores)	356,000	200,000
Shales	760,000	50,000
Total, process development	3,116,000	2,250,000

4. Equipment not included in construction projects, $693,000

Equipment for fiscal year 1958 will be required in support of the program's exploration, process development, uranium concentrate and ore-buying activities. Costs are estimated at $693,000 for fiscal year 1958 as compared to fiscal year 1957 estimates of $461,000. Of the fiscal year 1958 estimate of $693,000, $410,000 is for the replacement of equipment, and $283,000 is for additional equipment. The following table reflects a comparison by installation of equipment costs with related other operating costs in the raw materials program:

[In thousands]

Installation	Fiscal year 1958	
	Other operating costs	Equipment costs
Colorado ore-buying stations	$11,931	$124
Monticello processing plant and Winchester Laboratory	5,977	147
Exploration—principal offices: Grand Junction and Washington	5,572	422
Total	23,480	693

MARKET FOR URANIUM ORES

Mr. RABAUT. Last year you indicated that mills processing uranium ore would possibly be competing with each other for ore by 1962. Does this situation look any better today.

Mr. STRAUSS. Mr. Johnson.

Mr. JOHNSON. I would say yes. I would say that there will be sufficient mills to take care of the production as now projected.

Mr. RABAUT. Your answer to the question, does the situation look any better today, is what?

Mr. JOHNSON. I am not sure as to what is meant by "better." Our point of view is that from the standpoint of the independent miners, the mining industry and the price for uranium concentrates, it is desirable to have a reasonably good competitive position and I think that that situation is developing.

Mr. RABAUT. Do you feel by 1962 there will be real competition in the processing of uranium and that there will be a sort of market?

Mr. JOHNSON. Yes, sir.

Mr. RABAUT. Evidently you favor a market of that type.

Mr. JOHNSON. I think we hope for a competitive market.

Mr. RABAUT. In other words, it would find its place.

Mr. JOHNSON. Yes; I think the long-range outlook should be pointed toward a competitive market for uranium, a commercial market, subject to the normal type of controls necessary in dealing with a material such as uranium.

VANADIUM PROCUREMENT

Mr. RABAUT. That is what we meant by the word "better." Since the vanadium goal of the national stockpile has been reached, why has it been necessary to continue procurement of any of this material?

Mr. JOHNSON. Under the public ore-buying schedule established at the beginning of 1948 and which has been continued, payment has been guaranteed to miners for both the vanadium and the uranium. During the earlier periods of our program, in order to get out the maximum production of uranium, it was necessary to utilize all of these ores and the production of vanadium was in excess of the commercial market, so the Commission underwrote the excess vanadium production which was transferred to the stockpile. For the last 2 years, we have received very little vanadium under our ore-processing contracts, and under our new contracts we are getting out of a liability to purchase the vanadium but we still have the liability to furnish a market for vanadium to the ore producers.

Mr. RABAUT. You state on page 19 that purchase of vanadium above that which industry absorbs is a contractual commitment and could cost up to $9,536,000 in fiscal year 1958. Are your contracts contingent on availability of appropriations.

Mr. JOHNSON. Our commitments are firm commitments. But we estimate we will receive only a small quantity of vanadium.

Mr. RABAUT. You said that it could mean up to $9,536,000 for the year 1958.

Mr. JOHNSON. We have in the past, I think, used 6 or 7 million dollars for the acquisition of excess vanadium that was produced in connection with the production of uranium. We do not anticipate that there will be heavy deliveries of vanadium on the basis of the

current demand for vanadium, and on the basis of experience over the past 2 years. Our 1958 budget is based upon experience of the past 2 years.

Mr. RABAUT. How do you arrive at this figure if you think there will be a lighter delivery?

Mr. JOHNSON. We do not have a provision for $9 million in the budget but we point out that if there should be no commercial market for vanadium, we have a contractual liability to purchase an amount estimated at that magnitude.

Mr. RABAUT. But this figure in your justification is notice to the Congress of its existence. What I want to know is, are you in a position to amend those contracts?

Mr. JOHNSON. We are not a position to amend existing contracts with reference to vanadium. However, we have greatly reduced our vanadium liabilities as a result of contracts that have expired and have been negotiated on an extended basis.

Mr. RABAUT. Suppose you had to meet some of these commitments, where would this money come from for this $9,536,000?

Mr. FIELDS. Mr. Chairman, if my understanding is correct, we would have to absorb it or we would have to come back for supplemental appropriations. It is a potential liability if the market is not there as it has been in the past. It is not, as I understand it, a contract subject to availability of funds.

Mr. RABAUT. We were wondering what activities you had in mind that you might put this to.

Mr. FIELDS. We are not asking for appropriations for that amount.

Mr. RABAUT. Are you doing something about your future contracts in this that would be an improvement?

Mr. JOHNSON. Yes; any contract that is terminating is not being renewed on the basis of vanadium liability. There was one that terminated on June 30 and the vanadium lability has been eliminated from that. It was impossible to do that during the earlier period, but the vanadium market has improved to the extent that the producers are willing to take the risks now.

THORIUM ORES

Mr. RABAUT. Last year there was some question about Brazil continuing her shipments of certain ores to the United States. Since you are stepping up your exploration work there from $90,000 to $100,000, can we assume that the question of shipment has been cleared up?

Mr. JOHNSON. The Brazilian Government terminated its contract for sale of thorium to the United States. The program of exploration in Brazil may be continued beyond August 1957, the expiration date of the present agreement, as a matter of assistance to Brazil.

Mr. RABAUT. Is there any money in this budget that might not be used then?

Mr. JOHNSON. Which sum, sir. Under the entire budget?

Mr. RABAUT. Yes, procurement.

Mr. JOHNSON. I think we have a reasonably close budget, sir, about 98 percent is for procurement. I can say that our budget for 1957 which was submitted to this committee a year ago, and that budget was made up probably 12 months prior to that time, was for $407

million, and our record of cost through May indicates that our actual expenditures for fiscal 1957 will be about $406,600,000 as compared with the estimate.

Mr. RABAUT. My question deals with Brazil. Is there any money in here for procurement from Brazil?

Mr. JOHNSON. No, sir.

URANIUM PROCUREMENT COMMITMENTS

Mr. RABAUT. That is all right. That is what I was thinking about.

Are you actually committed to take the total production of uranium, both foreign and domestic, under your present unit price contracts?

Mr. JOHNSON. For the period of the contracts; yes, sir.

Mr. FIELDS. Did you say total production?

Mr. RABAUT. Yes. Are you actually committed to take the total production of uranium, both foreign and domestic, under your present unit-price contracts?

Mr. JOHNSON. Our unit-price contracts in each case call for a specific tonnage of uranium for delivery over a specific period of time and that is the limit of our commitment.

Mr. RABAUT. How long are some of those periods of time?

Mr. JOHNSON. Our Canadian contracts for the most part terminate on March 31, 1962, with some deliveries extending to March 31, 1963. The South African contracts, in which the British have an interest, expire from 1963 to 1966 with only small tonnage running to 1966.

Our Belgian contract will be completed in 1960 with options to extend it, if the Commission desires to do so.

Mr. RABAUT. Now, the price of this uranium is on a sliding scale of some type or varies from different locations.

Mr. JOHNSON. It varies in different countries. The pricing arrangements are different. The general order of prices is about the same. In Canada we have fixed price contracts which extend to March 31, 1962. The Commission has an option to extend those contracts for an additional 5 years if it so chooses.

In south Africa, the contracts are on a cost-type arrangement, not on cost plus, but if the costs are reduced and profits increase, the price goes down.

The domestic contracts are fixed unit price contracts for the period of the contract.

Mr. FIELDS. Mr. Chairman, he was for the most part discussing our commitments on foreign contracts.

I believe, to make this answer complete, Mr. Johnson, you should set out the guaranteed schedules for the Plateau and how they operate.

Mr. JOHNSON. Our contracts with domestic mills extend for the most part until March 31, 1962, which is the period of the ore-buying contracts. The Commission also announced about a year ago a concentrate procurement program which will extend from March 31, 1962, to the end of 1966 at a flat price of $8 per pound for limited production from each operation.

Mr. RABAUT. That is for the extension period?

Mr. JOHNSON. For the extension period.

Mr. RABAUT. Before it is in total production.

Mr. JOHNSON. Before that, for each mill it is the quantity for which we contract. All of the concentrates are purchased under specific contracts for specific tonnages.

Mr. RABAUT. I get to this word "total" in my first question. The question was, are you actually committed to take the total production of uranium. Then I said from foreign and domestic sources, and so on, under your present contract. Is the answer "yes" or "no"? For the regular period, not for the extended period. You have explained the extended period. But what is the situation for the first period under your present unit price contracts?

Mr. JOHNSON. Each of the milling contracts is for a specific tonnage of uranium for the period of the contract which generally runs until March 31, 1962. In addition we have the commitment to purchase the ores from the producers. As a matter of fact, we now purchase a relatively small percentage of the ores. Most of the ores are sold to the mills, but we have an obligation to furnish a reasonable market to the ore producers. If the ore production expands beyond the mill capacity, we attempt to furnish a market either by making additional milling contracts or by stockpiling the ore.

Mr. RABAUT. Then the answer is yes, taking the total production.

Mr. JOHNSON. Domestic, yes, sir.

Mr. RABAUT. And on the foreign, you take it under the specific amounts in the contract.

Mr. JOHNSON. The specific amounts in the contract, yes, sir.

Mr. RABAUT. If this is so, the committee actually does not know what the Federal Government will be obligated for ahead of time, is that right? So that we may know how good your estimating is, please put into the record a tabulation showing your uranium procurement cost estimates and actual expenditures for each of the last 5 years.

Mr. JOHNSON. We will furnish that for the record.

(Information of a classified nature was furnished to the committee.)

Mr. RABAUT. What percentage of the free world's production of uranium concentrates and oxides are we purchasing? You can just estimate it now.

Mr. JOHNSON. On an estimated basis, we are purchasing about 85 percent. That does not include France which has production of its own, and we do not have complete information on their production. They have not supplied uranium to the Commission. It is estimated at about 500 tons.

Mr. RABAUT. This is estimated without taking into calculation the production that France has.

Mr. JOHNSON. Yes.

Mr. RABAUT. The material that we do not buy, for instance, and the material that we say we are not getting from France, is that material available for weapons?

Mr. STRAUSS. Let me get your question again.

Mr. RABAUT. We are getting about what percentage——

Mr. STRAUSS. Around 85 percent.

Mr. RABAUT. The other 15 percent, is that available for weapons, and is the material that is not included in this from France, is that available for weapons?

Mr. STRAUSS. The other 15 percent, practically all of it is being acquired by the United Kingdom. We believe that the bulk of their material is committed to weapons and reactors. In our own situation, the only amounts committed for use for other than weapons or military reactors are the 100,000 kilograms that the President has designated for peaceful use half here and half abroad, which 100,000 kilograms will only be required over a considerable period of time, 10 or more years.

Mr. RABAUT. I understand about all that, but I am talking now about this other material, this 15 percent, and the material that is not taken into consideration in establishing the 100 percent, which is the material from France. Is that material usable for weapons?

Mr. STRAUSS. Yes.

Mr. RABAUT. The reason I ask that is this, that we really are not in full control. We are in control to a great degree, but not to a perfectly safe degree, of the nuclear weapons program for the free world.

Mr. STRAUSS. No, and of course, far more interesting than that, is the fact that there is a production of indeterminate amount behind the Iron Curtain which not only we are not in control of, but which we would have every reason to assume was largely destined for weapons.

Mr. RABAUT. Does anybody want to ask some questions about raw materials?

Mr. RILEY. I do, Mr. Chairman.

Mr. RABAUT. We will start with Mr. Riley.

FUTURE PRODUCTION OF URANIUM

Mr. RILEY. Dr. Johnson, I notice here that the expected increased tonnage in the United States is 39 percent and in Canada 242 percent. Is there reason to believe that that percentage would be increased in the years to come?

Mr. JOHNSON. The Canadian production is fixed, practically fixed at the present time by reason of the Canadian contracts. The Canadian program will be practically in full operation in fiscal year 1958. As a matter of fact, the program was frozen in 1955, and the production coming in 1958 will represent the completion of new plants that were planned and covered by commitments made a couple of years ago. It will not be expanded unless Canada finds outside markets. The domestic production will expand rapidly in 1958 and 1959 and in 1959 our production will be equivalent to the Canadian.

The Canadian production as you have pointed out increases much more rapidly in fiscal 1958 than the American production. That is the result of completion of mines and mills, but by the end of fiscal 1958 the Canadian program will have been completed. The domestic production will still be expanding.

Mr. RILEY. Do they have other sources of material that may be brought into production or use or do you know?

Mr. JOHNSON. In Canada?

Mr. RILEY. Yes.

Mr. JOHNSON. Canada's production is capable of expansion from known resources and undoubtedly if exploration were to continue they would find additional sources, but exploration for uranium in Canada

has declined as a result of our limiting purchases of Canadian uranium concentrates.

Mr. RILEY. If we had need to increase our purchases, do you think it is possible that they could expand their production?

Mr. JOHNSON. Yes, sir.

Mr. RILEY. What about in this country? What are the prospects for expanding our own production?

Mr. JOHNSON. Our production is expanding. It could be expanded more, but we are now following the policy of stretchout and endeavoring to have long-range production as opposed to the program that we necessarily followed a few years ago of trying to get all of the uranium out of the ground as fast as possible. Most of the larger companies now going into domestic production are not only planning on the Government market that has been extended to the end of 1956, but they are looking toward the commercial market after that period. I feel optimistic over the outlook for domestic production, but nevertheless our total known reserves are not large, considering the long-range future power programs. But I believe that we have had experience enough to justify optimism on maintaining reasonable uranium reserves in this country.

Mr. RILEY. Thank you, Mr. Chairman.

Mr. RABAUT. Mr. Evins.

INCREASE IN PROCUREMENT

Mr. EVINS. Mr. Johnson, the large increase in appropriation under this category is over $200 million for materials; $200 million is a pretty substantial increase in purchases. In answer to a question from our chairman, you indicated you were not committed to purchase the entire output but your statement on page 16 of your justification says that you are committed under firm contracts to purchase all uranium offered.

Mr. JOHNSON. In the United States.

Mr. EVINS (reading):

> The Commission is committed under existing contracts, domestic and foreign, with foreign governments to purchase all uranium offered in any given year.

Mr. JOHNSON. What page is that, sir?

Mr. EVINS. Page 16.

Mr. JOHNSON. I think there is an error in the statement.

Mr. EVINS. The last paragraph on page 16 says you are committed to purchase all offered.

Mr. JOHNSON. That is qualified by the following: "Subject to overall commitments based upon the various contract periods." That statement is not entirely accurate. Our Canadian contracts do cover a rate of production from each of the individual properties. In the case of the South African mines, where uranium production is a byproduct from gold operations, the limitation is on the size of the existing plant, and as the grade of ore is very uniform, production varies only slightly with variations in operation and changes in recovery rates. The individual production of the South African mines are quite uniform based on the capacity of the plant, which is described in the contracts.

Mr. EVINS. You are purchasing substantially all that is offered or are some mines holding back for price reasons or other reasons?

Mr. JOHNSON. In the past we have been puchasing all that has been offered. As a matter of fact, we have been anxious to get full production from every source in order to meet the requirements for fissionable materials. We are now approaching a more comfortable supply position and as in the case of some of the domestic mills we will probably impose restrictions on the rate of production which we have not done in the past.

Mr. EVINS. Since your stockpile is in a rather good condition and you are making these contracts on the 10-year or long-time basis, would it not be possible this year to defer, say, $100 million of your $200 million request?

Mr. JOHNSON. The foreign contracts, as I mentioned, are firm contracts but we are not making new contracts. We have made no new commitments for foreign production for about 2 years, and even in the case of Canada, we are only fulfilling commitments covered by earlier overall commitments with the Canadian Government. Now the only area where we are making new contracts is in the United States and here we have to fulfill an obligation to furnish a market to domestic miners.

Mr. EVINS. What percentage of your total purchases are domestic as against the foreign?

Mr. JOHNSON. About 37 or 38 percent domestic, and the balance foreign.

Mr. EVINS. Has the domestic been on the increase or reverse?

Mr. JOHNSON. The domestic has been on a sharp increase. Our production in fiscal 1958 will be about 10,400 tons from domestic sources. In fiscal 1957 it was 7,500, and in fiscal 1956 it was under 6,000 tons.

Mr. EVINS. Of course we recognize you are the experts and no one wants our country to be short, but we here have a responsibility to find out where reductions can be made. Also, it seems to me you have almost carte blanche authority to commit the Government to contracts and then come to the Congress and say, "We made firm contracts and we must have this money." Should there not be some area of agreement or limitation, rather than having open end authority?

Mr. JOHNSON. The Division of Raw Materials, of course, has no responsibility for determining requirements. Our responsibility is to meet the requirements. Goals have been established and our procurement contracts will not carry us beyond the established goals.

Mr. EVINS. Are your minimum goals reached in raw materials? Your minimum goals in concentrates have not yet been reached?

Mr. JOHNSON. No, sir.

Mr. EVINS. How far are you away from the minimum goal?

Mr. FIELDS. Mr. Evins, our minimum goal as set at the present time contemplates the needs for all the raw material that has been discussed here as being under commitment. This arises from forward planning with respect to the military requirements, the studies of capacities of our plants and what they can produce and a projection of them 10 years in advance. The goals have been set on the basis of that projection of military requirements for material. The present goal was last set upward, I believe, about a year ago.

Mr. EVINS. That is all, Mr. Chairman.

Mr. RABAUT. Mr. Boland.

Mr. BOLAND. Why is the price per pound of uranium in Australia high compared to other countries?

Mr. JOHNSON. We have a cost-type contract in Australia. The two operations are conducted by Australian Government agencies and their costs are high. The Australian Government is realizing only a small profit, because operations have turned out to be high cost.

Mr. BOLAND. I know that that tapers off pretty well, does it not, for fiscal 1958, almost 100 tons, I think.

Mr. JOHNSON. Australia in 1958 is 250 tons. That is not due to the tapering off of Australian production, but the Australian contracts are joint contracts with the United Kingdom under the Combined Development Agency. Because the Commission's requirements have been the largest, it has been receiving in the past the major part of the allocation of the CDA contracts, but the British are now taking a larger proportion of all material sold under CDA contracts. Our percentage of both Australian and South African and, for that matter, Congo as well, will be lower. The British allocation will be higher.

NATIONAL STOCKPILE

Mr. BOLAND. Does the AEC have any relationship with the national stockpile? Do you advise ODM as to what particular materials are critical and should be in the stockpile?

Mr. FIELDS. We do have a relation with them, sir, but actually the uranium stockpile is the responsibility of the Commission. We advise them of what we do.

Mr. BOLAND. Is thorium a critical material that is in the national stockpile?

Mr. JOHNSON. No, sir; it is not.

Mr. BOLAND. This is what the AEC uses on its own?

Mr. JOHNSON. Yes, sir.

Mr. BOLAND. Do you do any procuring for the stockpile?

Mr. FIELDS. Vanadium has been furnished to the stockpile.

Mr. JOHNSON. That was furnished to the stockpile not under arrangements with the stockpile, but it was surplus to the Commission's needs and, under the Stockpiling Act, material surplus to the needs of any Government agency is tendered to the national stockpile.

Mr. BOLAND. That is all. Thank you very much.

CONTROL OF USE OF MATERIALS

Mr. TABER. You stated in answer to a question by Mr. Rabaut that we are producing, perhaps controlling, 85 percent of the raw material, and Britain about 13, and you did not know much about what the French have. Could you tell us something about that?

(Discussion off the record.)

Mr. TABER. Supposing we supply a sufficient quantity of fissionable material for the purpose of the operation of reactor plants in different places around the world, is it readily convertible into war weapons?

Mr. FIELDS. Mr. Taber, the agreements for cooperation that we have negotiated and are negotiating carry a limitation with respect to the material we provide these countries in large quantity for use

in powerplants or reactors. As we understand this material and its behavior you could not easily use it in weapons. Beyond that, we have not entered into any arrangements or agreements as to safeguards and without an agreement that we can have teams go in to verify that the material is being used only for the peaceful purposes indicated. The material that is supplied to them is not directly usable in weapons. They could enrich the material through using the same process we do here to make it usable for weapons. That is the reason that we have agreements on control to guarantee that the material is to be used for peaceful purposes, and agreements under which we can assure ourselves that their safeguards are satisfactory.

Mr. BOLAND. Will the gentleman yield?

Mr. TABER. Yes.

Mr. BOLAND. We have some testimony that the French were not in the weapons business yet. I have a report prepared by the Library of Congress. This is not a confidential document at all. It says since the Suez fiasco, the French have talked increasingly in terms of diverting some of their material to weapons. They have also a nuclear-powered submarine for the navy.

(Discussion off the record.)

1957 EXPERIENCE

Mr. TABER. All the way through this book on raw materials, have you given your expenditures or what you figure your expenditures were in the fiscal year 1957 along with your request for the 1958 figure?

Mr. FIELDS. Yes, sir; page 14 I believe is the summary.

Mr. TABER. I wanted to be sure that we had that information. How do these figures that you have here for 1957 compare with your actual obligation in the year 1957?

Mr. JOHNSON. Our actual cost in the year 1957?

Mr. TABER. Yes. Take page 14. Is that figure of $406 million pretty close to the mark, or is it quite a ways away?

Mr. JOHNSON. We will probably be right on that mark, sir; on the basis of the 11 months actual known cost we will be about $406 million for 1957. We do not always come that close, but this time we are remarkably close to the estimate.

Mr. MCCARTHY. Could I point out, Mr. Taber, these are revised pages which we have submitted to the committee in order to reflect the 1957 experience through May.

Mr. TABER. These are revised right up to date?

Mr. MCCARTHY. That is correct.

Mr. FIELDS. They are based on actual expenditures through May with projections for June.

Mr. MCCARTHY. We do not have the final report, but it is based on experience through May.

Mr. JOHNSON. I would like to point out that the estimate we presented to Congress a year ago was $407 million.

Mr. TABER. I think that is about all I have.

REDUCTION IN THE PROGRAM

Mr. JENSEN. The members of this committee certainly would not take it upon themselves to blindly make a cut in your appropriation because of the fact that it is such an important function. However, it may be that after this so-called post mortem of your budget request for this committee you might be able to find an item or two that you could reduce to a degree, and if so, of course we would be very happy if you would so inform the committee. As a member of the committee—I am not speaking for everybody else, but I think I speak for some on the committee—I would not like to have it on my conscience, I would not like to go to bed at night after we have made a cut and feel that I had done anything that would in any way, shape, or form deter the activities of this important task which you gentlemen have on your shoulders. That is why I make the request that after these hearings are over and you, as I have said, have a post mortem of this whole budget request which is presented by you gentlemen, if you can conscientiously and safely make a recommendation to us where we might reduce your budget in any way, shape, or form, that you do so because I know every member of the committee would appreciate your saying so.

That is all.

PRICE OF URANIUM

Mr. RABAUT. Dr. Fenton.

Mr. FENTON. What is the average unit cost of U_3O_8 now?

Mr. JOHNSON. It is approximately $10 a pound of U_3O_8. The estimated average cost for 1958 is $10.40 a pound.

Mr. FENTON. That is now lower than it used to be.

Mr. JOHNSON. Yes, sir.

USES FOR VANADIUM

Mr. FENTON. I notice you have gone into considerable length in your justification of vanadium. Vanadium is a byproduct in the processing of uranium. Of what value is vanadium? What use can you put vanadium to?

Mr. JOHNSON. The value of vanadium is about $1.10 a pound for vanadium pentoxide, which is the form produced at the mills. Under the price for surplus uranium in connection with our milling contracts, we pay about 99 cents a pound.

Vanadium is used as an alloy for steels. There was a great demand for vanadium during World War II, and the Government had a vanadium program on the Colorado Plateau. During the Korean war, if it had not been for the vanadium that was produced in connection with uranium production, there probably would have been a runaway price on vanadium as there was with tungsten and some of the other metals. It is a valuable alloy material for industrial use, and particularly for armorplate in wartime.

Mr. FENTON. It still has a great value as far as you are concerned?

Mr. JOHNSON. Yes, sir.

Mr. FENTON. That is all.

Mr. RABAUT. Because of the rollcall vote upstairs and the hour is 10 minutes to 4, I think we will adjourn until 10 o'clock tomorrow morning.

THURSDAY, JULY 11, 1957.

Mr. RABAUT. The committee will come to order.

ADDITIONAL WING FOR GERMANTOWN BUILDING

Before we enter into this special nuclear materials program, inasmuch as there has been action on the wing to be placed on the building out in Maryland, it might be well, Mr. Fields, for you to make known what the intentions of the Commission are relative to going ahead with this program now and in what manner you would like to finance it.

Mr. FIELDS. Mr. Chairman, as our chairman stated yesterday, H. R. 6978 was before the House. However, S. 1918, a companion bill, was passed by the House yesterday. Both Houses have now passed S. 1918 which authorizes the additional wing. The act increases the previous authorization in the amount of $10 million for our buildings to $13,300,000. We have not as yet submitted our supplemental budget for the 1958 plant appropriations. It will follow whenever our complete authorization bill has been passed. We do, however, have moneys available from previous years savings or deferral of projects which could be applied to the increased cost of $3.3 million for this project.

Mr. RABAUT. You have unobligated balances in savings?

Mr. FIELDS. Yes, sir; we have unobligated balances in the plant appropriation that could be applied against this additional amount of $3.3 million.

The additional wing is required to house the personnel that are presently authorized for our headquarters here in Washington.

I should indicate, Mr. Chairman, that back in February we advised the chairman of the Appropriations Committee, Mr. Cannon, of this.

Mr. RABAUT. I am aware of that. It is well to have you mention it, though.

Mr. FIELDS. It is our understanding that it is necessary to mention it as we did not wish to apply moneys for this purpose without the approval of the committee.

Mr. RABAUT. Is the contractor there now?

Mr. FIELDS. The contractor is there working on the present building. The construction of a building under the $10 million previously authorized is proceeding. It is a complete project in itself. We would go out for this additional construction on competitive bids. While our present contractor has equipment mobilized there, we feel confident he will bid. We hope to get good competition nevertheless. This point was discussed with the Joint Committee on Atomic Energy when they took up the authorizing legislation and we assured them that we intended to do this by competitive bidding.

Mr. RABAUT. Would immediate approval of the committee effect savings in this regard inasmuch as you really have it up for competitive bidding anyhow?

Mr. FIELDS. The earlier we can get started, the better. We believe there will be savings in construction with an earlier start. Additionally, until we do have such a wing completed, we will be forced to continue to house about 200 people in Washington in rented space which the General Services Administration must provide for us until such time as the wing is completed and we can move the personnel to the headquarters at Germantown. We believe there are good reasons to proceed as expeditiously as we can and that there will be some savings effected.

Mr. RABAUT. How far out is the new headquarters from the city?

Mr. FIELDS. It is about 25 miles.

Mr. RABAUT. How is the housing situation out there?

Mr. FIELDS. It would not be possible for everyone to be housed in the immediate vicinity of Germantown. There are developments, however, in the Rockville and Bethesda areas, and elsewhere in that neighborhood. We have recognized that we are going to have difficult problems, as Mr. Evins brought out yesterday, in the question of relocating our headquarters, but the basic decision was made several years ago to go forward with the move as a matter of decentralizing important headquarters of this nature from Washington. Unfortunately, we will have substantial losses of personnel, particularly in those instances where two people in a family are working in different agencies. It is this kind of thing that makes the move difficult.

Mr. RABAUT. There is something that comes naturally to mind with this statement. How do you account for the building of an additional wing when in the same breath you are saying that you expect to have personnel loss? And why was not taken into consideration in the beginning that you might have personnel losses out there because of the distance and moving to a new location like that at Germantown?

Mr. FIELDS. It was taken into consideration, Mr. Chairman. We were aware that we would have losses. We will have to recruit and fill the vacancies. We consider that the strength authorized for Washington now is necessary for the conduct of headquarters affairs. Although there may be some temporary decreases in employment, vacancies will have to be filled in order to carry out the functions we have in Washington.

Mr. RABAUT. Now, there is this placing of a wing on the building. The other building is not yet completed.

Mr. FIELDS. It will be completed near the end of this year.

Mr. RABAUT. In one breath you are going to have personnel loss. The very building of the wing presupposes you need extra people.

Mr. FIELDS. No, sir. I am sorry if I have left that impression. We will need to house 1,758 personnel as of this time. The building that we are building out there has the capacity to house approximately 1,400 people with appropriate space, and could be stretched to house 1,550, sir.

Mr. RABAUT. The present building?

Mr. FIELDS. The present building; yes, sir.

Mr. RABAUT. What is your personnel at the present time?

Mr. FIELDS. The personnel at the present time for which we provide housing here in Washington is 1,700, sir. Is that not the right figure, Mr. Derry?

Mr. DERRY. Yes, sir.

Mr. FIELDS. Which is comparable to the space which we have to provide.

Mr. RABAUT. Is this body personnel?

Mr. FIELDS. Yes, sir.

Mr. RABAUT. About 1,700 body personnel.

Mr. FIELDS. It is about 1,700. We will have to house 1,758 altogether when we move out from Washington. There are certain offices associated with the Reactor Development Division and military personnell that will have to be housed with us.

Mr. RABAUT. I think it is a good idea to be out of the city but I was going to ask this question. What additional personnel is required just because of the fact that you do go out of Washington?

Mr. FIELDS. Can you answer that, Mr. Derry?

Mr. DERRY. There are no additional personnel required on the Commission staff, sir.

Mr. RABAUT. There must be some additional personnel required when you move out of the city. What are you going to do with transportation?

Mr. DERRY. The additional personnel will be furnished by GSA in the operation of the building. They furnish personnel now for operation of buildings in Washington. With the operation of the building in Germantown, they will necessarily furnish personnel for the operation of the building.

Mr. RABAUT. Will GSA support the personnel outside the city of Washington?

Mr. DERRY. After the first year of operation, yes, sir.

Mr. RABAUT. Is that the general practice?

Mr. MCCARTHY. That is the general practice, sir.

Mr. RABAUT. Outside the city?

Mr. MCCARTHY. Yes, sir.

Mr. RABAUT. Does the committee feel we had better let them go ahead with this? We can say we will let them know.

Mr. TABER. I do not know why you would not go ahead.

Mr. RABAUT. I do not see why they could not go ahead. We authorized them before. They got the legislation passed last night. Do you think it is all right?

Mr. TABER. I think so.

Mr. RABAUT. How about it?

Mr. EVINS. I am in agreement with the chairman since the legislation has been passed, but the chairman asked a question which, General Fields, is not quite clear in my mind. Why did not the original plans embrace this additional wing? Were you shortsighted?

Mr. FIELDS. No, sir. As I recall it was early 1955 when the discussions took place with the Joint Committee as to a new headquarters for the Atomic Energy Commission. Our staff was split up in three building them. The JCAE was then considering the lease-purchase approach. In the discussion the Committee decided that a better way was to authorize a building. At that time it was estimated that a strength of approximately 1,500 would be housed in Washington. Subsequent to that time, with the buildup of the civilian activities of the Commission and with our programs of international cooperation, we have had an increase of several hundred in Washington headquarters.

Mr. EVINS. In other words, the Commission staff has grown so much in the past few years it is now necessary to add an additional wing which was not planned originally.

Mr. FIELDS. That is correct, Mr. Evins. We are not, however, requesting any increase in personnel over the presently authorized strength for the Washington headquarters.

Mr. EVINS. Would it be the better part of wisdom and economy to wait a year after you move and see if the new wing is needed?

Mr. FIELDS. We do not believe so, Mr. Evins, because we do not have adequate space out there right now for the personnel we now have.

Mr. RABAUT. Any further questions?

Mr. BOLAND. You are going to have some difficulty in holding your present personnel. The fact of the matter is that you are not going to lose the real key personnel; you are going to lose the clerks down the line. They are not going to be too difficult to replace after you have been there a while.

Mr. FIELDS. I think that is the situation.

Mr. BOLAND. It is not too far away. That area will be developed. There will be housing in time. I think the problem is a very minor problem actually. I would agree. I think we ought to go ahead and let them do this thing.

Mr. RABAUT. I will say this for the record. There appears to be no objection by those assembled. We will let you know.

Mr. FIELDS. Thank you, sir.

SPECIAL NUCLEAR MATERIALS PROGRAM

Mr. RABAUT. Now we will take up special nuclear materials program. We will insert pages 25 and 26 of the justifications.

(The justification follows:)

SPECIAL NUCLEAR MATERIALS PROGRAM—OPERATING COSTS

Program statement

Estimate, fiscal year 1958	$594,253,000
Estimate, fiscal year 1957	586,720,000
Increase	7,533,000

Summary of estimates by category

	Actual, fiscal year 1956	Estimate, fiscal year 1957	Estimate, fiscal year 1958
1. Procurement and production	$521,240,757	$553,383,000	$560,143,000
2. Process development	31,852,255	33,337,000	34,110,000
Total, special nuclear materials program	553,093,012	586,720,000	594,253,000

JUSTIFICATION OF CATEGORIES

1. Procurement and production, $560,143,000

These funds provide for the operation of Government facilities for the production of special nuclear and other special materials required for use in weapons manufacture, research and development, and in the industrial programs for the peacetime applications of atomic energy. The major units of this production complex are located at Oak Ridge, Tenn., Paducah, Ky., Portsmouth, Ohio, Hanford, Wash., Savannah River, S. C., Fernald, Ohio, and St. Louis, Mo.

Although there is a major increase in the quantity of ore to be processed, the increase in costs is moderate since unit costs of processing have declined in most of the steps in the production chain.

2. Process development, $34,110,000

These funds provide for improvement of processes and equipment used in producing uranium feed materials, enriched U–235, plutonium and other special products. This development program is the means by which productive capacities, without new capital facilities, may be increased and economies and reductions in unit cost of products may be achieved. It will be noted that, despite the remarkable achievements of process development in increasing production, reducing costs and reducing capital equipment needed to meet requirements in the past, potential payouts from further work are considered to be so significant that continued process development remains well justified during the foreseeable future.

NEED FOR INCREASE

Mr. RABAUT. It is evident from your justification statement that you are rapidly improving your unit production cost, but your overall request for this program is $7,533,000 above the 1957 estimate. In view of the total size of the program, which is $594,253,000, isn't it reasonable to assume that you could get along without this increase?

(Discussion off the record.)

Mr. RABAUT. Do you need that entire increase? What causes that increase? You know we are dealing with big figures here. Of course it is small relative to the total cost, but nevertheless it is a very sizeable sum.

Mr. BLOCH. Mr. Chairman, page 28 of the justification indicates by category the increases and decreases. Feed materials accounts for some of the increase. In 1958 we will be processing more feed material than in fiscal 1957.

Mr. RABAUT. Here is our picture now. Your unit cost has gone down, is that right?

Mr. BLOCH. Yes, sir.

Mr. RABAUT. You are going to use more dollars in new feed material. Where is the reflection of the unit cost going down? Why should not that unit cost going down somewhat wipe that out?

Mr. BLOCH. In the feed materials, sir, even though the unit cost goes down you have an increase in the amount of production of feed material.

Mr. RABAUT. Then it is a relationship between the increase in the units produced, a reduction in the cost of power, and an increase in the amount of feed material.

Mr. BLOCH. Yes, sir.

Mr. RABAUT. And through those three categories you arrive at the fact that you are going to have an overall increase.

Mr. BLOCH. Yes, sir.

Mr RABAUT. Can't you people absorb this 1 percent, roughly? I know it is a nice picture to put before us, but I think you ought to be able to absorb it.

Mr. BLOCH. As Mr. McCarthy indicated yesterday, we recently have reviewed both our 1957 experience and our 1958 requirements. This is really our best judgment as to what we need to operate the program and to achieve our production objectives.

(Discussion off the record.)

Mr. RABAUT. Suppose we would not give you this extra 1 percent here or a little over 1 percent; would the defense suffer?

Mr. FIELDS. We have changes in 15 categories, which result in the total increase of $7 million. There are increases and decreases, varying as between the categories. Some are increased markedly, some are decreased.

(Discussion off the record.)

Mr. RABAUT. What is your unobligated balance on this particular program for this year?

Mr. MCCARTHY. None, sir. The amounts shown represent the actual 1957 cost.

Mr. RABAUT. What was it as of the day you took it?

Mr. MCCARTHY. On this program in 1957 we had an underrun of some $16 million against a $603 million budget.

Mr. RABAUT. Here you have your fiscal 1957 estimate $604,819,000. You estimated the last 2 months, too, did you not?

Mr. MCCARTHY. Just the last month.

Mr. RABAUT. Even under that estimate you are only going to use $586,720,000.

Mr. MCCARTHY. That is correct, sir.

Mr. RABAUT. Does that not sort of solidify my argument?

Mr. BLOCH. Mr. Chairman, in 1957, first of all, the underrun was 3 percent of our estimate. The reasons for the underrun were a combination of things.

Mr. RABAUT. That is true. We are going to give you credit for all that. You were 3 percent within your estimate. We are talking now about 1¼ percent, 1½ percent. You certainly could not be that much off. Why not knock off this $7,533,000?

Mr. FIELDS. Mr. Chairman, it seems to me it is probably in the realm of the accuracy with which we can estimate this program. On the other hand, could I be allowed this point? The 1958 estimates are based on anticipated lower unit costs, not all of which have been com-

pletely realized as yet. Also, we cannot, as you know, include amounts for wage increases which may take place during the year.

Mr. RABAUT. On page 28 you show a miscellaneous item of $844,991 in 1956, $2,364,000 in 1957, and $502,000 in 1958. What was your 1957 estimate as given the committee last year and what is the reason for the change?

Mr. BLOCH. The major cost in 1957 in this time was associated with a fire at Paducah, Ky., in one of our process buildings. In 1957 $1.6 million was spent in work associated with restoring the production building in which the fire occurred.

Mr. RABAUT. The fire then was figured at what price?

Mr. BLOCH. In fiscal 1957, $1.6 million.

Mr. FIELDS. That was not in the budget as it came up.

Mr. RABAUT. No. Your regular figure was $721,000, but the fire caused the difference.

Mr. FIELDS. Yes, sir; the fire caused the difference.

Mr. RABAUT. That was a rather expensive fire.

Mr. FIELDS. We thought it was going to be worse than that.

Mr. RABAUT. Is that the fire that was only announced 3 months after it happened?

Mr. FIELDS. No, sir, it was announced the same day.

Mr. RABAUT. There was one fire that we got the announcement that something happened I don't know how many days afterwards. You may have announced it around the shop, but it did not get out in the press, one of those fires.

Mr. BLOCH. Sir, this one was announced in the press within a few hours after the fire occurred.

Mr. RABAUT. In the current year you must have realized some of these excellent reductions in unit cost with consequent savings. Will any of the appropriated funds so saved revert to the Treasury, or have you proceeded on your own decision to increase production and soak up the savings?

Mr. FIELDS. As Mr. McCarthy indicated, there has been a reduction of $16.0 million in this program in 1957. That is included in the unobligated balances to be applied to 1958.

UNOBLIGATED BALANCE

Mr. RABAUT. What was the unobligated balance?

Mr. MCCARTHY. For this appropriation, we have declared $53,100,000 to the Bureau of the Budget.

Mr. RABAUT. When did you start running these overproductions?

Mr. MCCARTHY. In which category is this?

Mr. RABAUT. In any category where savings were effected you started to have additional production, did you not?

Mr. BLOCH. Our production in 1957, our actual production was essentially what we had forecast in our program for fiscal 1957.

Mr. RABAUT. That is all you did then?

Mr. BLOCH. And the savings were available to be applied.

Mr. RABAUT. The savings were available for application on your new reduced cost?

Mr. MCCARTHY. Through reappropriation.

Mr. RABAUT. They will be deducted from the appropriation?

Mr. McCarthy. They will be deducted from the appropriation required in 1958.

Mr. Rabaut. That is what you call your unobligated balance?

Mr. McCarthy. Yes, sir.

Mr. Rabaut. What does that amount to?

Mr. McCarthy. That is $53,100,000.

Mr. Rabaut. What about production figures under this chart on page 28? We do not have that. Could you supply them to us? Are they classified?

Mr. Fields. The actual figures are classified.

Mr. Bloch. While these are still classified, I could mention generally some percentages.

Mr. Rabaut. All right. You give us a percentage change between actual and estimated. You estimated them for 1957 and you have had certain percentage changes. You can supply it to us and it will be classified. Mark that classified, but just supply it so the committee will have it. It will save a lot of time.

Mr. Fields. Yes, sir.

DECREASE IN POWER COSTS

Mr. Rabaut. It appears on page 33 that you will reduce your power consumption from the TVA by a substantial amount during 1958. Please explain that now.

Mr. Bloch. As indicated earlier, during the years when we were short on feed to produce uranium 235, we offset this by buying additional power under short-term agreements, agreements covering periods of several months or a year at the outside. Now that our feed situation has improved and there is an increased supply of uranium available, we no longer need to buy this temporary power. So in fiscal 1958 power for the gaseous diffusion plants will be reduced to the power that we can get under our permanent long-term contracts. This was a plan, visualized from the very beginning, that at some point we would just take the power that we had contracted for on a long-term basis and would cease purchasing interim power under the short-term contracts. Of course, under those short-term contracts the power is more expensive than our permanent power supply.

Mr. Rabaut. In other words, the power you are dropping from TVA you are making up for with power you are generating yourselves?

Mr. Bloch. No, sir, we are making up for it by having additional uranium to put into the plant.

Mr. Fields. When the production programs were laid out over a long period several years ago the permanent power plan was developed on the basis of production requirements over a period of time. On that basis we determined how much permanent power we should contract for so that the facilities could be built. Thus the power would be cheap over a long term. It was never intended that interim power would be utilized over the long period.

Mr. Rabaut. It is the interim power that you are cutting.

Mr. Fields. Yes, sir.

Mr. Rabaut. You have sufficient power with your firm power.

Mr. FIELDS. Yes, sir.

Mr. RABAUT. Long-term power.

Mr. FIELDS. Yes, sir.

Mr. RABAUT. How much power are you dropping from the TVA system and how much from what other sources?

Mr. BLOCH. From TVA we are dropping around 500,000 kilowatts.

Mr. TABER. Where?

Mr. BLOCH. 170,000 kilowatts are being dropped at Oak Ridge, and about 330,000 kilowatts at our Paducah plant. These quantities fluctuated somewhat during the course of the year, depending on availability, since this was interim power. However, on the average they supplied about 500,000 kilowatts to us last year, which they will not be supplying in fiscal year 1958.

Mr. RABAUT. What will that mean in loss of revenue to the TVA?

Mr. BLOCH. I think I can give an approximation on that, sir.

Mr. RABAUT. If you do not have it now, you could supply it later.

Mr. FIELDS. We can give you an estimate now.

Mr. BLOCH. In 1957 our total purchases from TVA amounted to about $125,400,000. In 1958 we estimate $106,200,000.

So that would be a reduction of about $19 million.

Mr. RABAUT. What is the similar situation with other power or power secured from other sources? I am talking about power secured from other sources. What are you dropping there?

Mr. BLOCH. At portsmouth we are dropping 120,000 kilowatts which the Ohio Valley Electric Co. has supplied.

Mr. RABAUT. How much?

Mr. BLOCH. 120,000 kilowatts. And at Paducah we have been getting 140,000 kilowatts from Electric Energy, Inc., which are being dropped in 1958. So in total we are dropping about 760,000 kilowatts.

Mr. RABAUT. What loss would that be to them?

Mr. BLOCH. It would be about $4,200,000 for the Ohio Valley Electric Co. at Portsmouth, Ohio.

Mr. RABAUT. What is the other one?

Mr. BLOCH. On the other one, the peak was 140,000 kilowatts. It fluctuated throughout the year from that peak. So, this figure does not relate directly to 140,000 kilowatts, but in 1957 we purchased interim power from EEI amounting to $2,750,000, which would be dropped in 1958.

Mr. RABAUT. Are you still taking some firm power from these sources?

Mr. BLOCH. Yes, sir.

Mr. RABAUT. This is just peak power, short term.

Mr. BLOCH. We are taking firm power under long-term contract with them.

Mr. RABAUT. You are keeping up your long-term contracts with private industry?

Mr. BLOCH. Yes, sir.

Mr. RABAUT. Now, are you going to take any short-term power from anybody else in any quantities at all?

Mr. BLOCH. No, sir. Our 1958 program is based upon long-term contract demand loads.

Mr. RABAUT. So, this is where the reflection comes in on the saving on power.

Mr. BLOCH. Yes, sir.

Mr. RABAUT. According to these figures I have, then, you have $19,200,000 in 1 place and $6,950,000 in the other 2?

Mr. BLOCH. On the basis of our 1957 usage.

Mr. RABAUT. This shows that practically all the savings came out of this power, and not too much came out of this unit-cost business.

Mr. FIELDS. This is the way the reduction in the total was taken. The actual processing of product will be even greater than it was last year, so you still will get a unit-cost decrease.

PRODUCTION RATES

Mr. RABAUT. The money here indicates the figure, but against this you still have what you claim is a greater number of units going through.

Mr. FIELDS. That is right.

Mr. RABAUT. With this reduction in power.

Mr. BLOCH. The picture generally is this: In fiscal 1958 we are going to process more feed. We are going to increase our production of uranium 235 over 1957, and we are going to increase our production of reactor products over 1957.

Mr. RABAUT. I do not understand the situation about your production in 1957. Your production, according to the testimony here, I feel, should have been up in 1957.

Mr. BLOCH. It was up over 1956.

Mr. RABAUT. I know, but you said a few minutes ago that your production is very close to your estimates.

Mr. FIELDS. It was projected to increase in 1957 over fiscal year 1956, sir, and it did.

Mr. RABAUT. But is the estimate that you gave us as your production according to the estimates you gave us in 1957, or is it above the estimates you gave us in 1957?

Mr. FIELDS. It is very close to the estimates upon which the 1957 budget was prepared, sir. Now, that budget anticipated a definite increase in the production rate over 1956.

Mr. RABAUT. So, then, that anticipated the lower unit cost.

Mr. BLOCH. Yes; that anticipated some reduction in unit costs. In fiscal 1958 we are projecting further increases in production.

Mr. FIELDS. Last year we gave the estimate of what the unit cost would be, just as we did this year in this budget. They were projected.

Mr. RABAUT. In your last year's estimate you have a unit cost under refining ore. Here in 1958 you show for 1957 a different amount. Now, that is a reduction, is it not?

Mr. BLOCH. Yes, sir. We did better than we had forecast.

Mr. RABAUT. The tonnage here in the line ahead was more than was projected for 1957. So your tonnage is up and your price is down.

Mr. BLOCH. Yes, sir.

Mr. RABAUT. So, there is an increase in production over your estimate.

Mr. MCCARTHY. In the individual items, there may be, sir. I think Mr. Bloch is referring to the overall production.

Mr. RABAUT. For instance, take uranium on the same line in the next column; you have the tons in the 1957 budget estimate of uranium and the unit price. Give us that percentage change in production that I asked for.

Mr. FIELDS. Yes, sir. It is a complex process, and you will have variations in each step.

(The information was supplied to the committee.)

Mr. BLOCH. Mr. Chairman, another general point, in 1958 there are increases in wages and there are increases in power cost due to fuel escalation. So what we have presented here is our best estimate. We have increases that we can see, offset by reductions, to arrive at our net of $7.5 million. Fuel costs, power particularly, are increasing.

Mr. FIELDS. There is one item in here that has a sharp increase.

(Discussion off the record.)

PROCESS DEVELOPMENT

Mr. RABAUT. Your estimate for process development is $34,110,000. What determines the level of this work from year to year?

Mr. BLOCH. The level is determined essentially by the requirements for development staff, for direct plant assistance, plus requirements to look at promising improvements which will save money or increase the capability of our existing plants. The slight increase in fiscal 1958 is a combination of some increase in cost plus the addition of a few technical personnel at the new Weldon Springs plant, which is just starting up, and a few personnel at the Portsmouth plant where they have problems coming up in connection with equipment and plant improvement.

It appears to us that the 1958 request here represents essentially a stable level in terms of the size of our technical staffs at each of our plants. There will be some slight fluctuations costwise even with a stable technical staff, dependent upon the type of work they are doing. Thus far the payoff in process development in terms of our ability to get much more out of existing plants has been tremendous and has saved a good many hundreds of millions of dollars in new plant investment that otherwise might have been necessary.

On the basis of the way it has paid out, it appears that it will continue to pay out and looks like a very good investment.

Mr. RABAUT. It is a sort of estimate, though, is it not?

Mr. FIELDS. It is based on experience.

Mr. BLOCH. It is based on experience, plus the present staffing at most of the plants with the small increases at the two plants I mentioned.

Mr. RABAUT. It is probably predicated on the number of people involved rather than the program.

Mr. FIELDS. It is based largely on people, but it is also related to our plants to the extent that they are very complicated and very large.

Mr. RABAUT. I am not questioning the results here. But that figure is predicated upon the number of people involved.

Mr. BLOCH. Not entirely, sir. There are definite programs at each of these facilities aimed at things which give promise of saving money or giving increased capacities.

Mr. RABAUT. Do you think it is an item that the committee might take a look at?

Mr. BLOCH. Sir, it has been the very heart of our program.

Mr. FIELDS. Mr. Chairman, practically every one of these processes involved in the special nuclear material production program are new processes and had never been in being until they were installed in conjunction with this program. On every one of them there is a great deal of development and improvement to be done after they are built and are operating. That can result in tremendous savings. If you shut off process development, you really shut off great savings in the future in the operation of the plants.

Mr. RABAUT. You say it is productive of savings to the Government?

Mr. FIELDS. Yes, sir, very much so.

(Discussion off the record.)

EQUIPMENT

Mr. RABAUT. Your item called "Equipment not included in construction projects" has drifted up from $6 million in 1955 to $11 million in 1956 and to $12,568,000 in 1957 and now is $19,361,000 in 1958. The only word I have after all that is, Why?

Mr. BLOCH. Basically it is because we have more plants to operate. During these years we have been adding to our production plant complex.

Mr. RABAUT. How many plants under the $6 million did you have then? In 1955 you had $6 million. How many plants did you have then?

Mr. BLOCH. In 1955 we had, to the best of my recollection, Hanford, Savannah River, Oak Ridge——

Mr. RABAUT. You can give them to us in numbers.

Mr. BLOCH. In 1956 some of our major plants were not in operation. The big Portsmouth plant was not in. Just the initial part of the Savannah River plant was in. The Weldon Springs plant had just been started.

Mr. RABAUT. In 1956, you had $11 million. What did you have added to make it $11 million?

Mr. BLOCH. Some of these plants that I have mentioned started coming in the next year, but they were not all in until fiscal 1957. In fiscal 1957, essentially all our plants except Weldon Springs were in operation. Meanwhile the plants are getting older. Also, when we get into higher production in some of these plants our requirements for replacement of process equipment increase, particularly in those facilities which are subject to corrosion.

Mr. RABAUT. Then you took one plant out this year.

Mr. FIELDS. The Dana plant; yes, sir.

Mr. RABAUT. Is that reflected in this $19,361,000?

Mr. FIELDS. That is reflected; yes.

Mr. RABAUT. There are some savings, but it does not show in the figure of course because the figure is up, but I presume it is included.

It sets forth an expense of $12,568,000 in 1957. Any questions on this?

Mr. EVINS. I have a few questions, Mr. Chairman.

Mr. RABAUT. That is the special nuclear materials program. We will confine our questions to that.

DECREASE IN POWER COSTS

Mr. EVINS. Mr. Bloch, on this special nuclear materials program I want to get clear in my own mind your reductions in power cost. In 1957 at Oak Ridge it was $72.4 million. In 1958 it is $65.6 million, a reduction of $6.8 million; is that right?

Mr. BLOCH. Yes, sir.

Mr. EVINS. For Paducah your power costs were $78.5 million in 1957 and are $64.7 million in 1958; is that correct?

Mr. BLOCH. Yes, sir.

Mr. EVINS. And for Portsmouth, your power cost was $69.5 million; for 1958 it would be $67 million.

Mr. BLOCH. Yes, sir.

Mr. EVINS. How much reduction do those three total?

Mr. BLOCH. Approximately $23 million reduction.

Mr. EVINS. That is reflected at Oak Ridge, Paducah, and Portsmouth, as you indicated. I did not quite get the correct amount at Paducah that you were going to be dropping from Electric Energy.

Mr. BLOCH. You mean in kilowatts?

Mr. EVINS. Yes, and also dollars.

Mr. BLOCH. I indicated that on EEI our maximum of interim power during 1957 was about 140,000 kilowatts, but that is not a constant load throughout the year and has fluctuated considerably. I also indicated that during the fiscal 1957, EEI was paid about $2.7 million for interim power.

I might point this out, sir, that just taking the total interim power cost that we dropped does not necessarily mean that our total 1958 costs are going to drop that much because there are increases in fuel cost and in permanent power costs in 1958 which are an offset.

Mr. EVINS. I was trying to get firm information on the amount of kilowatts you were going to drop and the amount of the cost. Let me see if I have this correct. For TVA you are planning to drop $19 million in cost. Your power cost to TVA for next year will be $19 million less. I would say that is commendable.

Mr. BLOCH. Yes, this is in terms of total cost.

Mr. EVINS. In terms of total cost, your power cost to TVA in 1958 will be $19 million less.

Mr. BLOCH. Yes, sir.

Mr. EVINS. How many kilowatts does that reflect dropping?

Mr. BLOCH. That reflects dropping approximately 500,000 kilowatts.

Mr. EVINS. At Portsmouth you plan on dropping 120,000 kilowatts. How much does that amount to in dollars?

Mr. BLOCH. On a net basis it amounts to about $2.5 million.

Mr. EVINS. For Paducah, Electric Energy, Inc., you plan on dropping 140,000 kilowatts; is that correct?

Mr. BLOCH. That is a peak figure. I do not know offhand what it would average over the years.

Mr. EVINS. You estimate that amount of reduction in dollars will be how much?

Mr. BLOCH. There is a net reduction of about $2.6 million. This is in terms of our total power bill.

Mr. EVINS. I think you are to be commended for those reductions if they can be made. Now, do you plan on purchasing any power from any other sources for these plants other than these three?

Mr. BLOCH. Our long-term power contracts for these plants are with TVA, EEI, and the Ohio Valley Electric Co., plus a relatively small amount of power we generate ourselves at Oak Ridge.

Mr. EVINS. And for the amount you are dropping you do not anticipate the purchase of this power from any other source.

Mr. BLOCH. No, sir, we are falling back to our long-term power suppliers.

Mr. EVINS. For the record, you do not have any Dixon-Yates plan underway or plans for any substitute power? We want that on the record.

Mr. FIELDS. We have no requirement at the moment for any large increase in power demand over what is projected in the fiscal 1958 budget for this program.

Mr. EVINS. Now, I have one other thing. How can you make these reductions, which, I say you are to be commended for if you make them, while at the same time you have a $7.5 million increase in your special nuclear materials program? That was the inconsistency which concerned me. You are reducing your power cost, but at the same time your costs in your program are up $7.5 million. How do you reconcile those two figures?

Mr. BLOCH. We have mentioned previously the offsetting increases in feed materials and other production.

(Discussion off the record.)

Mr. EVINS. My question is, can you increase your special nuclear materials program without increased power?

Mr. BLOCH. Yes, sir, that comes about because we have increased feed. In other words, while we are dropping power we are processing the additional uranium that is available and this gives us an increase in production even though we have cut back on power.

Mr. EVINS. Is that about the same thing as you said to the chairman awhile ago, and I did not get it clearly, and I am not so sure he did either, that you are producing your own power needs.

Mr. BLOCH. No, sir. In the gaseous diffusion plants which produce the enriched uranium, you have your basic plant and its equipment. The amount of product you get is a function of the capability of that plant, the amount of uranium that you feed into the plant, and the amount of the power. All these things in the aggregate determine how much production you get.

Now, we have been short of material to feed into the plant during past years. We have compensated for that shortage by putting additional power into the plant that was over our normal load. Now we will process the increased deliveries of uranium and cut back on power by eliminating the temporary power.

The reason this additional power was temporary is that this was our plan from the very beginning.

Mr. EVINS. And correspondingly if you increase your materials program with further acquisitions you could probably make further reductions in power consumption, following that logically. Is that possible?

Mr. BLOCH. Or, if you hold your power, you can produce more product with the additional feed.

Mr. FIELDS. These factors work directly with each other only within a certain range. There is, however, a point where if you put in additional feed material, you get out very little additional product. So it is a varying function.

Mr. EVINS. You think you have gotten down to the level with your long term firm power contracts and dropping the interim power?

Mr. FIELDS. We could use more power and get more production at this stage. But the 1958 estimate has been projected on the basis of the production goals set for fissionable material. On that basis, we do not need more power than we have asked for in fiscal year 1958. But we could get additional production by using more power with the amount of uranium feed that is available.

Mr. EVINS. You have made that clearer to me, and I thank you. That is all, Mr. Chairman.

Mr. RABAUT. Mr. Taber.

Mr. TABER. Your power saving is very largely the elimination of that interim power.

Mr. BLOCH. Yes.

Mr. TABER. You have converted a smaller amount of permanent power than the amount of interim power that you have given up. Has that been due to some better methods of handling it or new processes or something of that kind?

Mr. BLOCH. Sir, we have given up the power. Because of the additional feed and the improved efficiency of our plants, we still get more production even though we give up this interim power.

Mr. TABER. I guess that is all I have.

Mr. EVINS. I would like to ask one more question. This is all marked as secret on the green sheets here and statements have been made on the record. Should any of these answers be put in the published report? Do you make this secret because you do not want someone to know the amount of your power consumption or the amount of cost? What is the reason for classifying this?

Mr. FIELDS. There are elements of it that are classified. The actual amounts of power used that are unclassified will remain in the record. When you put all this information together and show the details, it becomes classified. On the basis of the power and the costs shown here, someone could estimate the amount of the production.

We will endeavor to review the record so that everything that is unclassified, such as the amount of power, the amount of reduction at the TVA or the amount at Paducah can remain in the record.

Mr. EVINS. Thank you.

Mr. FIELDS. The information that you took down, Mr. Evins, with respect to power is unclassified.

Weapons Program

Mr. Rabaut. Now we will take up the weapons program. Insert page 46 into the record.

(The justification follows:)

Weapons Program, Operating Costs

Program statement

Estimate fiscal year 1958	$452,346,000
Estimate fiscal year 1957	318,740,000
Increase	133,606,000

The amount requested for fiscal year 1958 for the weapons program reflects the estimate of funds needed for the development, production, testing, and storage of atomic weapons required to meet military needs.

Research in a variety of subjects has continued to yield new developments applicable to weapons; these will be incorporated in the design of new and improved weapon models which will greatly enhance the capabilities of the Armed Forces. The developmental effort will necessitate a continuation of weapons testing activities, which are essential to advancement in this field.

(Discussion off the record.)

Mr. Rabaut. Does this require a 40 percent increase in appropriation?

General Starbird. Yes, sir, it does to get the weapons that the Department of Defense needs.

Mr. Rabaut. This increase then is predicated upon the information that you have up to the present time. You do not know what the changes will be during the year.

General Starbird. No, sir, we do not know the changes that will come about during the year.

(Discussion off the record.)

Physical Research Program

Mr. Rabaut. We will now take up physical research. We will insert pages 120 to 131 in the record.

(The justification follows:)

Physical Research Program—Operating Costs

Program statement

Estimate fiscal year 1958	$71,000,000
Estimate fiscal year 1957	60,652,000
Increase	10,348,000

The physical research program comprises basic investigations of the natural laws that have special relevance to the Commission's activities and responsibilities. The investigations are in the fields of physics, mathematics, chemistry, and metallurgy and are undertaken to improve our command of nuclear technology, and to accelerate and expand the developments of the uses of atomic energy. In retrospect, every advance in atomic energy capability can be traced to laboratory research of the type proposed under this program. About 70 percent of the program is carried on in the Commission's laboratories. Nearly all of the remaining 30 percent is contracted to university laboratories where the work is closely integrated with postgraduate training in research.

The increases proposed in fiscal year 1958 are as follows:

Area	*Increases over fiscal year 1957*
Continuation in fiscal year 1958 of expanded effort initiated in fiscal year 1957	$2,268,000
High energy physics	2,239,000
Equipment not included in construction	1,236,000
Chemical properties and reactions	1,134,000
Computer development and mathematics research	1,021,000
Nuclear structure and neutron physics	528,000
Process chemistry	511,000
Alloy theory and nature of solids	416,000
Other (net)	995,000
Total	10,348,000

Summary of estimates by category

Category	Actual fiscal year 1956	Estimate fiscal year 1957	Estimate fiscal year 1958
1. Isotope process development	$272,590	$356,000	$370,000
2. High energy physics	10,490,331	12,930,000	15,169,000
3. Nuclear structure and neutron physics	9,709,407	10,631,000	12,084,000
4. Extra-nuclear properties of matter	727,644	683,000	742,000
5. Design and development of devices for physics research	2,428,679	3,377,000	3,560,000
6. Physical methods of isotope separation	429,727	570,000	595,000
7. Computer development and mathematics research	130,666	979,000	2,000,000
8. Process chemistry	4,639,021	4,877,000	5,507,000
9. Classified project "A"	1,110,529	1,199,000	1,410,000
10. Chemical properties and reactions	10,468,522	11,889,000	13,973,000
11. Chemical isotope separation studies	706,614	532,000	560,000
12. Production, treatment and properties of materials	1,852,582	2,052,000	2,411,000
13. Alloy theory and the nature of solids	2,580,668	3,443,000	3,859,000
14. Effects of irradiations on materials	951,431	1,170,000	1,560,000
15. Equipment not included in construction projects	3,000,112	5,964,000	7,200,000
Total physical research program	49,498,523	60,652,000	71,000,000

JUSTIFICATION OF CATEGORIES

1. Isotope process development, $370,000

Radioisotopes are produced to meet the requirements of Atomic Energy Commission research programs and for distribution to persons licensed by the Commission to possess and use byproduct materials. Stable isotopes are produced primarily to meet Atomic Energy Commission research requirements; stable isotope samples not required for Atomic Energy Commission use are sold or loaned for research use by others. Both radioactive and stable isotopes are sold or loaned at prices established on the basis of recovering full costs of production and distribution. The amounts budgeted here are for developing and improving processes for the production of radioisotopes. The costs of production and revenues from the isotope distribution program are included under the inventory and revenue sections of the budget.

The increase of $14,000 for fiscal year 1958 provides for slight additional emphasis on the development of processes for producing and recovering short-lived isotopes for bio-medical applications.

A complete picture of the production costs, distribution credits, and sales for both radio and stable isotopes is as follows:

	Fiscal year 1956	Fiscal year 1957	Fiscal year 1958
Radioisotopes:			
Production costs	$1,676,756	$2,276,000	$2,351,000
Distribution credits	(341,271)	(629,000)	(657,000)
Sales	(2,213,404)	(2,160,000)	(2,178,000)
Stable isotopes:			
Production costs	599,256	621,000	621,000
Distribution credits	(45,404)	(26,000)	(26,000)
Sales	(83,721)	(53,000)	(53,000)

2. High energy physics, $15,169,000.

Studies in high energy physics seek an understanding of the fundamental properties of nuclear matter. The tools of the investigator in this field are the high energy accelerators such as the 6-billion-volt proton accelerator at Berkeley (the Bevatron), the 3-billion-volt machine at Brookhaven (the Cosmotron) and several other machines at university sites. These investigations are rapidly extending the horizons of fundamental knowledge. Since the facilities in use represent a large capital investment, it is both progressive and economical to support their fullest possible use. The requested funds contemplate eventual round-the-clock operation. They also provide for continuing modification and improvement of the accelerators and the auxiliary equipment used to study the phenomena of interest. Each experiment suggests new experiments, better methods for operating the accelerators, and improved instrumentation for carrying out the measurements and observations. The cost levels for the operations also increase, but the rising costs are more than compensated by the more effective use of the facilities and more rapid accumulation of new knowledge.

The effects produced when a beam of high-energy particles from one of these accelerators strikes a target are extremely complicated. Novel and expensive equipment is needed to disentangle the various kinds of reactions that are produced. Many reactions involve the production of strange new particles not ordinarily found in nature, such as the recently discovered antiproton and other less publicized but equally significant entities such as the antineutron. Although knowledge in this new realm is increasing rapidly, there is as yet no clear understanding of these phenomena nor any end in sight to the investigations.

The program planned for fiscal year 1958 will continue the operation of the existing high-energy accelerators at university sites at slightly higher levels, consistent with the projected availability of graduate students, and it will significantly increase the utilization of the cosmotron and bevatron (and the operating cost levels) by taking advantage of new research techniques and higher beam intensities resulting from recent advances. High-energy research programs will also be expanded at Princeton, University of Pennsylvania, Harvard, and Massachusetts Institute of Technology, looking toward the effective use of the two accelerators which are now under construction by those institutions. The increase of $2,239,00 is entirely consistent with the growing interest in this field of science and with the fundamental contributions these results are making to our understanding of the sources of atomic energy.

3. Nuclear structure and neutron physics, $12,084,000

Research relating to low-energy nuclear processes, such as those involved in the release of atomic energy, is budgeted in this category. An important activity is the direct measurement of reaction, absorption, and scattering cross sections of all kinds of nuclei for incident neutrons, protons, and other nuclear projectiles whose energies range from thermal energy to several tens of millions electron volts. The sources of these particles are cyclotrons, electrostatic generators, betatrons, synchrotrons, and other intermediate energy accelerators. In addition to particle accelerators, nuclear reactors are used as intense sources of neutrons in the thermal and epithermal energy regions. These neutron sources are used in conjunction with crystal spectrometers and choppers to provide monoenergetic neutrons. The cross sections of fissile nuclei are of vital importance, but equally important to reactor technology are the inelastic, neutron-scattering cross sections of moderators, coolants, and structural materials.

From the cross-section measurements and other related studies of radioisotopes, knowledge of nuclear structure is obtained. This knowledge is of immediate interest to the designers of nuclear reactors and weapons, and will, eventually, it is hoped, result in a synthetic understanding of all nuclear structures.

In addition to vigorous programs at 5 national laboratories, research in this category is carried on at approximately 40 educational institutions. The facilities at these institutions range from a unique neutron velocity spectrometer operated by Columbia University to small Van de Graaff generators and Cockcroft-Walton accelerators, and from the new heavy-ion accelerator at Yale to the modest equipment used for studying radioisotopes. Of the increase of $1,453,000 in this category, $528,000 will be used to broaden the scope of existing projects and to support programs at new institutions, and the balance of $925,000 represents the continuation in fiscal year 1958 of the expanded effort initiated in fiscal year 1957.

4. Extranuclear properties of matter, $742,000

Investigations in this category deal with atomic, as opposed to nuclear, structure. These include infrared and optical spectroscopy, molecular forces, and ionization. Here also are budgeted the investigations of low-temperature phenomena and the physical properties of liquids and gases. An increase of $59,000 is budgeted for expansion of the present work at universities, and new work directed toward use of nuclear techniques in meteorite research and allied problems.

5. Design and development of devices for physics research, $3,560,000

Progress in physics research goes hand in hand with the development of new research tools. There are always crucial experiments, long conceived, but which await the development of new devices and new techniques for their accomplishment. Existing accelerators can be made to operate at higher energies, greater intensities, and better resolution, and new types of accelerators can be devised. Existing particle-detection devices can be made more sensitive, faster, more discriminative against background, and better able to resolve energy. New types of detectors can also be devised. Instrumentation development is being undertaken to support work at accelerators, both existing and under construction. Each advance in the art makes possible new experiments and quantitative improvements on old experiments, both of which advance scientific knowledge.

The net increase of $180,000 results from minor readjustments in projects to meet program requirements.

6. Physical methods of isotope separation, $595,000

The narrative pertaining to this category is included in the classified portion of the justification material.

7. Computer development and mathematical research, $2,000,000

The highly complex, technical, and interrelated nature of the Commission's program has led to considerable dependence on the use of high-speed automatic computers in most phases of its activities. Numerical computations are of growing importance in weapon design, reactor design, particle accelerator design, meteorology, the statistical aspects of fallout, Project Sherwood, plant design and operational analysis, geological surveys, process flow, and a host of other applied activities. They are also assuming an important role in areas of basic research important to the Atomic Energy Commission, such as theoretical nuclear physics, molecular physics, chemistry, solid state, statistics, particle trajectories, theory of turbulence, magnetohydrodynamics, thermodynamics, and meteorology.

The funds requested under this category are for research programs at universities, Government laboratories, and industrial organizations to improve computer components and the logical design of computers and the application to actual computing systems. Also included in this category are funds required to provide for the use of computing equipment by universities and other laboratories in research programs of interest to the Commission.

Computers currently available to the Commission, or under development, are not adequate to meet the Commission's current or projected needs in this field. It is expected that this support of computer research will stimulate the development and construction of the required advanced computers, as well as providing the means for the incidental research in programing, numerical analysis, and general problem-solving techniques.

8. Process chemistry, $5,507,000

The narrative pertaining to this category is included in the classified portion of the justification material.

9. Classified project "A," $1,410,000

The narrative pertaining to this category is included in the classified portion of the justification material.

10. Chemical properties and reactions, $13,973,000

Studies in this category represent a wide variety of long-range, basic investigations in fields related to the interests of the Atomic Energy Commission. These fundamental studies are the core of the chemistry research program, and the knowledge gained therefrom will serve as an indispensable foundation for the future advancements in the chemical aspects of the application of nuclear energy. Programmatic or developmental work depends very heavily on fundamental knowledge of the properties and behavior of the materials being used.

Without an adequate supply of such information developmental activities proceed slowly and blindly.

Research included within this category covers the following general fields: (1) Nuclear chemistry, or the study of the processes leading to the production of new nuclides by the interaction of various particles with nuclei. Conditions for reaction, cross sections for various types of processes are investigated. Also included are the studies on transmutation by radioactive decay—the identification of decay products, the particles emitted, and the energy changes. (2) Radiation chemistry, or the study of the effects of electromagnetic radiation and particles on matter. Obviously this field is of primary interest to the useful application of atomic energy. A basic understanding of the chemical reactions involved, the rates of these reactions and the products of the reaction contribute to the advancement of reactor technology. (3) Hot atom chemistry, or the chemical reaction of an atom or molecule that ensues as a result of the energy released in nuclear transformations. (4) General inorganic chemistry studies are designed to supply the quantitative thermodynamic and kinetic data pertaining to solutions of inorganic materials and properties of inorganic solids. The various investigations include studies of the following properties of many chemical systems: determination of the solubilities, oxidation states, species in solution; distribution of various species between two or more phases, including ion exchange phases. (5) High temperature chemistry has become, and will continue to be, of great importance to the atomic energy program. Studies in this area involve the investigation of the kinetics and equilibria of reactions and chemical systems at elevated temperatures—in the gaseous, solid and liquid (including molten) states. Fused salt systems will receive considerable attention. Thermodynamic data are obtained on dozens of reactions not previously studied in the temperature ranges of present interest. The techniques involved represent new approaches in the design and operation of laboratory equipment—such as the operation of precision balances at a temperature in the order of many hundreds of degrees. (6) Basic research in analytical chemistry relates to many other research programs. (7) The organic chemistry program is small in comparison with others in this category. It relates to organic materials which play an important role in atomic energy. (8) Studies of isotope effects involve theoretical as well as experimental research, and include research on the effect of mass differences on chemical reactions. Such effects are the basis for chemical isotope separation processes. The above listing of broad fields is intended to be primarily illustrative, not exhaustive.

Most of the off-site, or university research contracts in chemistry are included in this category. Of the total increase of $2,084,000, $950,000 represents the continuation in fiscal year 1958 of the expanded effort initiated in fiscal year 1957. The balance of the increase ($1,134,000) is for the following programs: (1) High temperature chemistry, $325,000; (2) radiation and hot atom chemistry, $125,000; (3) nuclear and radio chemistry, including work with the cosmotron, bevatron and heavy linear accelerators, $500,000; (4) physical and inorganic chemistry, $76,000; and (5) fundamental studies related to corrosion phenomena, $108,000.

11. Chemical isotope separation studies, $560,000

The narrative pertaining to this category is included in the classified portion of the justification material.

12. Production, treatment and properties of materials, $2,411,000

This program is devoted to research and development on metals, alloys, and ceramics that are of special interest to the Atomic Energy Commission. The requirements for materials in the atomic energy program are severe and often unique, and in many cases the efficiency or even the feasibility of a design or system depends upon the properties of the available materials. Since many of the operational factors in atomic energy are unusual, the conventional materials are often unsuitable. Under this category considerable attention is devoted to problems relating to the use of uranium, thorium, and plutonium as fissionable or fertile materials. Typical efforts are the development of improved processes for extracting and purifying these metals, investigation of new uranium alloys, and the development of new ceramic fuel elements impregnated with fissionable material for use at high temperatures.

Nonfissionable materials are also included in the program with particular attention to materials for possible use as a fuel element clad, moderator, control rod, etc. This activity includes research and development on new extraction

processes for vanadium, niobium, and the rare earths, and the metallurgical characteristics of these metals and their alloys; the behavior and properties of graphite and ceramics; and the general physical metallurgy of materials of interest in the atomic energy program. Another phase of the effort is concerned with research and development on improved barriers for the gaseous diffusion process.

This category also includes the very important field of corrosion and the development of corrosion resistant alloys. The trend of reactor design is imposing still more severe corrosion problems on materials.

A total increase of $359,000 is requested for fiscal year 1958. Of this amount, $156,000 represents the continuation in fiscal year 1958 of the expanded effort initiated in fiscal year 1957. The balance of $203,000 is required as follows: (1) A new pure-metals program, $63,000; (2) strengthening and extending the current programs on corrosion, ceramics and plutonium, $100,000; and (3) expanding the program on niobium, a metal that is of considerable interest in some of the Atomic Energy Commission's reactor programs, $40,000.

13. Alloy theory and the nature of solids, $3,859,000

This program includes fundamental studies to increase our understanding of the nature and properties of solids with the purpose of achieving improved materials for the atomic energy program. The research projects include investigations on the nature of cold worked metal; the processes of recovery and recrystallization, diffusion and sintering in metals and ceramics; the nature of lattice imperfections and solid solutions; the structure of metals and alloys; the thermodynamics of solids; and the mechanism of phase transformations. This category also includes basic studies in solid state physics such as soft X-ray spectroscopy, low temperature specific heat, X-ray and neutron diffraction, nuclear and paramagnetic resonance studies, and others.

An increase of $416,000 is requested to provide for increased research in solid state physics ($200,000), high temperature metallurgy ($108,000) and fundamental physical metallurgy ($108,000).

14. Effects of irradiations on materials, $1,560,000

One of the unique circumstances involved in the use of materials in the atomic energy program is the fact that they may be exposed to irradiation for prolonged periods. This condition can produce drastic changes in the behavior and properties of materials and restricts their selection. The research program in this field is devoted to three general areas: (7) an understanding of the theory and basic mechanism of the effect of irradiation on solids, (2) the effect of irradiation on the kinetics of metallurgical processes, and (3) a practical evaluation of the performance of certain materials under irradiation. Although considerable progress has been made in the field of irradiation effects, there still remain many difficult problems from both the fundamental and applied standpoint.

An increase of $390,000 over fiscal year 1957 is required as follows: (1) Continuation in fiscal year 1958 of the expanded effort initiated in fiscal year 1957, $118,000; (2) the effect of metallurgical factors on the dimensional instability of uranium and its alloys under irradiation ($70,000); (3) increased effort on the basic mechanisms by which radiations affect metals, semiconductors, and ionic crystals ($120,000); and (4) expansion of the study of the effect of irradiation on physical metallurgical reactions ($82,000).

15. Equipment not included in construction projects, $7,200,000

Equipment requirements for the physical research program are estimated at $7,200,000 for fiscal year 1958, which represents an increase of $1,236,000 over fiscal year 1957. The request for fiscal year 1958 is based on normal equipment requirements as indicated by past experience, including provision for additional requirements to cover the expanded research effort proposed for fiscal year 1958. Approximately two-thirds of the increase requested is required to support a higher level of physics research which includes research with large machines, such as accelerators and research reactors, requiring relatively high equipment costs. The balance of the increase is required for research in the fields of chemistry and metallurgy.

There follows a breakdown of the total equipment costs indicating amounts estimated for each major installation in relationship to its other operating costs under this program.

[In thousands]

Installation	Other operating costs	Equipment costs
University of California Radiation Laboratory, Berkeley, Calif.	$10,175	$1,900
Oak Ridge National Laboratory	9,577	2,000
Brookhaven National Laboratory	8,039	1,180
Argonne National Laboratory	8,765	671
Ames Laboratory	2,395	200
All other	24,849	1,249
Total costs	63,800	7,200

Mr. RABAUT. It is rather difficult for laymen to understand exactly what is being accomplished with the millions going into this type of research. Can you tell us in simple terms some of the actual accomplishments that have been achieved in the last year?

Dr. JOHNSON. I will do my best, sir.

Of course, the progress of science has been continuous since the ancient Greeks, and what we are doing now is based on what has been accomplished over the ages. This program is carrying on in the best possible traditions the progress of science in these particular fields of nuclear technology and understanding of the atomic nucleus.

PROGRESS IN 1957

Now, this last year has been a very productive year in all branches of science, especially in the nuclear field. I can give you a few highlights.

I think perhaps the most significant progress from the point of view of basic scientific development in the nuclear field has been with the ultrahigh energies that are produced in these large accelerators you have provided funds for in years past. There is the bevatron at Berkeley which generates a proton beam of 6 billion electron volts of energy, and the cosmotron which generates 3 billion volt protons. These have been used for the first time in research to probe into the nucleus and to learn more in detail than has been possible heretofore as to what the nature of the forces are that hold nuclear matter together to form the atomic nuclei, and what the composition of these nuclei are.

The nucleus is a very complicated structure and there are over a thousand different nuclei among our elements. So the study has been greatly involved. There has been a major—I won't call it a breakthrough—but a major advance in understanding nuclear questions which occurred just last January. It grew out of experiments which had been done with the bevatron and with the cosmotron, experiments which had been taking place during the last year or two. It was realized by two very brilliant young physicists that if we adopted a new and rather radical principle thing could be clarified. This on closer examination seemed to be not inconsistent with other things, although at first it had been thought so. This is a principle of great generality, comparable with the principle of relativity, for example, which Einstein enunciated in 1910.

Experiments have been done to corroborate this new way of thinking and these new ideas are certain to pervade the whole of scientific thinking from now on throughout the future.

Just what their consequences will be, nobody knows, but if this turns out to be as important and as productive as, say, the theory of relativity, there may be some use of science which will occur 10 or 15 years from now which we do not even anticipate at this time.

Mr. RABAUT. You predicate your statements on two words you have used here. What are they? What do they mean? You know, we are just a bunch of laymen.

Dr. JOHNSON. That is why I have avoided going into too much detail here. As a matter of fact, I would not attempt to try to give you an advanced lecture in nuclear science.

Mr. RABAUT. What is this thing you are talking about?

Dr. JOHNSON. What I would like to bring out is that as a result of these experiments with the high-energy machines there has been a major advance in scientific thinking which will pervade the whole of science in the future. That has just occurred this year. It is a discovery which is comparable in importance with the discovery of the theory of relativity. This is one of the kinds of things that is happening in this program. It is occurring because we do have these large facilities which cost a lot of money.

At the same time it has brought out a situation among our scientists which has a certain effect on the budget. It has increased the interest and enthusiasm of our leading scientists for advanced work. It has also rejuvenated the programs which have been carried on with some of the machines built 10 years ago. These now seem like very modern instruments, where as they were getting to be a little bit old. A new idea will put new zip into the program just like a new machine will.

Mr. JENSEN. It is a challenge, in other words.

Dr. JOHNSON. It is a new challenge, that is right.

FUNCTION OF ACCELERATORS

Mr. RABAUT. Is this related to a breakdown after you get through with the atom? Is it an electrical field? What is it? I realize you know something about it, but you have not imparted it very well to me.

Dr. JOHNSON. With these large accelerators you bombard a target with high-energy particles. Out of the target come effects, radiation, which are studied. Now, the nature of these rays that come out of a target that has been bombarded has been quite a puzzle. There are new kinds of particles which no one has ever seen before. We call them mesons. They are fundamental entities which we believe are closely associated with the force that holds nuclear matter together.

These particles are of very short life. They decay and they produce other things. There is a tremendous variety of them. The whole study involves many, many experiments and many, many people, theorists, as well as experimentalists. It is a whole new field of science that is building up for the first time around these large machines. Our progress is very encouraging. It is very fundamental. It is the most fundamental thing you can think of in the structure of matter. Just what its application will be, no one can tell at this time.

Mr. RABAUT. Now there is an old theory, you do not destroy anything, but you put it in a different form. Is that right? Something stays here?

TRANSFORMATION OF MATTER AND ENERGY

Dr. JOHNSON. There is a conservation of the sum total of matter plus energy, but matter can be transformed into energy and energy can be transformed into matter. We are doing this every day in these large machines.

Mr. RABAUT. I have often thought what the scientists' answer is. Take, for instance, all the gasoline that is burned up every day. What becomes of that?

Dr. JOHNSON. Most of the mass of that goes into the atmosphere in the form of carbon dioxide, but there is some loss of matter which is equilibrated to the energy that is produced. That is very small, of course.

Mr. RABAUT. Is the energy destroyed?

Dr. JOHNSON. The energy goes into heat, the tires heat the road, and the surface of the earth gets warmer, and so on. This accounts for a gradual increase in the mass of the earth. So there is nothing lost except what is radiated away.

Mr. RABAUT. You see what I am trying to bring out?

Dr. JOHNSON. I could refer to some other elements of progress if you like.

Mr. RABAUT. All right, let us have them.

PROGRESS IN CHEMISTRY

Dr. JOHNSON. In the field of chemistry, we have made substantial progress in understanding the geochemistry of uranium, how uranium gets deposited where it is, and in what form it was originally before it was deposited. We have made progress in understanding and studying the chemical reactions at high temperatures and some progress in corrosion. Corrosion is a very important problem in some of our reactors. We have put a good deal of emphasis on this during the last year and made some very substantial progress.

Mr. RABAUT. What is the source of uranium?

Dr. JOHNSON. It is found in the earth, of course, in the form of ores. There are two kinds of ores which are most prevalent, pitchblende and carnotite.

Mr. RABAUT. What type of ore is pitchblende?

Dr. JOHNSON. One of them is merely U–308.

Mr. FIELD. Uranium oxide.

Mr. RABAUT. It is found in some rocks, types of rocks?

Dr. JOHNSON. Yes.

Mr. RABAUT. Would it be possible to find uranium in the desert?

Dr. JOHNSON. Whether it is a desert or not would make no difference.

Mr. RABAUT. For instance, if you found uranium in the desert and it could be put into use there, and then if these laboratories could be set up there, you would have everything there. You have power. When you have power you can find water. I do not know how far you have to go for it but you can find it. Then you have vegetation, and then you can turn great areas into very productive property. You

know, this atomic energy could in a way change pretty much the face of the world. When you think that coal is so inaccessible to so many areas, and so much has to be used, you realize what we could be looking forward to. Some of the developers could find things developing against their best interests. It could happen. We hope it won't happen. Still, it would be for the best of the world.

RELATIONSHIP OF URANIUM TO OTHER SOURCES OF ENERGY

How much uranium equals a ton of coal or 10 tons of coal? I saw a man who had a piece of uranium not quite as round as this, it was smaller, it might have been a trifle longer. He said this will run the electrical energy of Detroit for 1 day.

While this may be very disturbing to my doctor friend down here who comes from a great coal district, nevertheless one man said it is a shame the way they are burning coal. He thought they ought to use it for its other properties. No wonder the Congress gets confused.

Dr. JOHNSON. A rough figure to keep in mind is that uranium is about 10 million times better than the same weight of coal.

Mr. RABAUT. What is the relationship of the estimated uranium that is in the world as compared to the other sources of energy?

Dr. JOHNSON. Mr. Putnam wrote a book on this subject called Energy for the Future. I think he estimated that the known reserves of uranium are about equal to 20 times the known reserves of coal and oil in terms of energy.

Mr. RABAUT. Those are the known reserves.

Dr. JOHNSON. That is right.

Mr. RABAUT. There are a lot of hidden reserves.

Dr. JOHNSON. There are a lot of unknown reserves in coal, oil and uranium.

NUMBERS OF SCIENTISTS IN RESEARCH PROGRAM

Mr. EVINS. Dr. Johnson, how many scientists do you have in your research division?

Dr. JOHNSON. Employed in the Washington staff?

Mr. EVINS. In your division, wherever they may be.

Dr. JOHNSON. You mean scientists employed doing research?

Mr. EVINS. How many scientists do you have in your Division?

Dr. JOHNSON. We have a small Division of administartive people here in Washington that numbers 33 in all, including secretaries.

Mr. EVINS. I asked about scientists.

Dr. JOHNSON. We have 13 scientists here in Washington.

Mr. EVINS. How many do you have in the field?

Dr. JOHNSON. In the field—last year we supported the work of 3,096 scientific man-years under this program.

Mr. EVINS. How many scientists does that represent?

Dr. JOHNSON. Some of them worked only part time.

Mr. EVINS. Two thousand?

Dr. JOHNSON. No; it is more than that. In some of our university contracts the senior scientist engages in teaching activities as well, so he devotes only part of his time to research work and is not counted as a full man.

Mr. EVINS. How many scientists do you have in the field? Can you cover that number?

Dr. JOHNSON. Including the national laboratories, the Atomic Energy Commission's own laboratories and the universities, the number is 3,558.

Mr. EVINS. How much personnel do you have in your Division?

Dr. JOHNSON. On the Government payrolls we have in all 33.

Mr. EVINS. You have 33 other employees in your Division besides scientists?

Dr. JOHNSON. No, that includes 13 scientists; and 20 others.

Mr. EVINS. And 3,558 in the field. That makes total personnel in the Division of how many? Can you give us the total figure of personnel, scientists, clerical, and all in your Division?

Dr. JOHNSON. There are no AEC employees in the field under this Division. These 3,558 are contractor scientific personnel.

Mr. EVINS. I understand. They are contracted on a full-time and part-time basis.

Dr. JOHNSON. That is right.

Mr. EVINS. You are counting them even though they are on a part-time basis.

Dr. JOHNSON. That is right.

Mr. EVINS. In addition to them and those you have here, what is the total personnel of your Division, counting those on a contract basis?

Dr. JOHNSON. I do not have that figure, sir. I think you could say there are roughly two nonscientists per scientist. In other words, if you multiplied this figure by three, you would not be too far off.

Mr. EVINS. I think we ought to have a firm figure as to the number of people in your Division.

Dr. JOHNSON. I can get it for you, but I don't have it here.

(The information follows:)

Total man-years for physical research program

	Fiscal year 1957	Fiscal year 1958
Washington Office, Division of Research:		
Scientists	13	15
Administrative and secretarial	17	19
Total	30	34
Contractor personnel:		
Scientists	3,096	3,324
Supporting staff	6,720	7,298
Total	9,816	10,622
Total physical research man-years	9,846	10,656

GOVERNMENT EXPENDITURE FOR RESEARCH

Mr. EVINS. Now, the Department of Defense is expending huge sums of money for research in all branches, in all divisions, the National Advisory Committee for Aeronautics does its principal work in research, and there are other agencies of Government in research. Do you know how much money our Government is spending for research in all operations, approximately?

Dr. JOHNSON. Yes, sir; I know what the National Science Foundation has reported on this. I had occasion to look it up quite recently in connection with a speech I made.

Mr. EVINS. The National Science Foundation, too, is another I did not mention. What was that figure?

Dr. JOHNSON. For research and development in 1957, I believe the figure was $2.7 billion, of which about $215 million was for what we might call basic research.

Mr. EVINS. How much for basic research?

Dr. JOHNSON. $215 million.

Mr. EVINS. $215 million for basic research and $2.7 billion for all types of research?

Dr. JOHNSON. And development.

Mr. EVINS. You had $61 million for research in 1957 and you are asking for $71 million in 1958. That is a $10 million increase.

Dr. JOHNSON. Yes, sir.

EXPLANATION OF INCREASES IN AEC RESEARCH PROGRAM

Mr. EVINS. I want to say, Doctor, that I have great admiration for you and for your Commission and for the field of science and the cause of security of our country but I would not say you have justified to me the reasons for a $10 million increase in this. You are supposed to justify your increase in appropriations but to me you have not satisfactorily justified the reasons why you should have $10 million more than you had last year.

Dr. JOHNSON. Perhaps I should try to do that, sir.

Mr. EVINS. I wish you would.

Dr. JOHNSON. The increases are listed under various categories on page 120 of this budget. The first item of $2,268,000 is a catchall item allocated to various categories not otherwise listed here representing the continuation into 1958 of the level of scientific effort as it has at this moment developed. In other words, this has been a growing program, we hope it will be next year, too. The average expenditure in 1957 does not represent our present level of spending. The average level would represent the level that we had reached, say, last January. In order to keep going what we now have underway in categories not otherwise designated here, we will need $2,268,000.

Now, in high-energy physics, we need $2,239,000. This is to implement the new opportunities which present themselves now for basic advances in the most inviting field of science with the high energy accelerators at Brookhaven and at Berkeley. I believe it was 2 years ago, we received funds from the Congress for 2 other high energy accelerators which have been contracted now, one to a group at Cambridge, Mass., comprising both Harvard and MIT scientists, and another one at Princeton, N. J., comprising both Princeton, and the University of Pennsylvania. Those two machines are under construction and the research programs for which they will be used are already developing. We want to have the people on hand, the equipment ready, and the experiments going, when those machines come in.

Mr. EVINS. In this connection, these machines at Princeton and Harvard, are they built by grants from the Commission?

Dr. JOHNSON. Yes, sir.

Mr. EVINS. After you make the grant to the university, do they make any contribution toward maintaining them or operating them, or does the Government make all the expenditures for operation after you have made the grant?

Dr. JOHNSON. I am sorry, they are not grants; they are contracts. The machines are being built by the Atomic Energy Commission at these sites with the idea of making use of the scientific manpower that is attached to these universities.

Mr. EVINS. Do the universities make any contributions?

Dr. JOHNSON. Yes, they make contributions, too.

Mr. EVINS. Go ahead.

Dr. JOHNSON. Equipment not included in construction shows a $1,236,000 increase. This is largely to implement these same programs in high-energy physics. These large accelerators require rather expensive equipment for the experimental program. There are also other items of equipment associated with our other programs. In addition to the accelerators I have already mentioned, we have two heavy ion accelerators which have just come into operation, one at Yale University—that is not quite in operation yet—and one that has just come into operation at Berkeley. These programs also require instrumentation for effective experimentation.

Another program requiring expensive instrumentation is the large cyclotron at Berkeley, which has been operated at an energy of 400 million electron volts.

Mr. EVINS. Are all these included in equipment not in construction?

Dr. JOHNSON. That is correct. That machine has recently been remodeled, so that it now generates 700 million electron volts. It is the highest energy machine of its kind in the world and it requires additional instrumentation.

Mr. EVINS. All right.

Dr. JOHNSON. Now, under chemical properties and reactions there is an increase of $1,134,000. This is for expanded programs in corrosion and in high temperature chemistry.

Under computer development and mathematics research we are asking for a $1 million increase. We have had a million dollars this year. We are asking for $2 million next year. The Commission is one of the largest users of high speed electronic computing equipment. We have been one of the principal purchasers of the machines of this kind from industrial suppliers and we have built a number of these machines in our laboratories. This is an art which was started by the ingenuity of the late Commissioner John von Neumann. I was with him at Aberdeen when the first computer was built. The Commission has done very little except in its own laboratories to promote the development of advanced new types of computers. Its support has been by purchases. But there are a number of ideas around at the present moment by which very substantially improved machines could be built, machines that would run faster, carry out the computations faster and handle more complicated problems than we have been able to handle heretofore. We believe that by supporting the development of computers and more effective methods of using these computers, we would more than be rewarded for the money we spend in future developments.

Mr. EVINS. All right. The next four you have $500,000 each. That is a $2 million increase in those.

Dr. JOHNSON. Nuclear structure and neutron physics is a field that we have been working in since the nuclear bomb program started. It is a field that is involved. There are thousands of different kinds of nuclei, each one has hundreds of different states that have to be studied an investigated. We have 55 Van de Graaff accelerators in the country now that we are supporting under this program. Some of these have just been purchased. It is the people trained under these programs who are most useful in our reactor development programs and the scientific investigations underlying new reactor programs. This represents an expansion in this effort which is commensurate with the opportunities that we seen in the scientific field.

Under process chemistry the increase is $511,000. This would be utilized mainly in corrosion research and in new methods of processing uranium fuel. As we get into more advanced types of reactors such as the liquid metal reactors or homogeneous aqueous reactors, the processing plant should be built right into the reactor to achieve the most economic operation. Although in this program we do not design plants for a specific reactor, we are looking in a more general way at the problems of fuel processing with the idea of improving the economy of power reactors in the future.

Mr. EVINS. You mentioned corrosion under one of your studies.

Dr. JOHNSON. There are two aspects of corrosion. Corrosion in the more basic sense is just chemical reaction between a metal and acids.

Mr. EVINS. Besides your 33 personnel and your 3,558 under contract, by how many additional personnel do you propose to increase your division in 1958 over 1957? Are you going to put on 100 or 200?

Dr. JOHNSON. The 3,558 that I mentioned was the staff as we had it on April 20 of this last year. I have it in scientific-man-years if you will take it that way.

Mr. EVINS. Just tell us the additional personnel you will employ.

Dr. JOHNSON. This is not personnel. This is scientific-man-years. In 1957 it is 3,096.

Mr. EVINS. I want it for 1958, Doctor.

Dr. JOHNSON. For 1958 it is 3,324.

Mr. EVINS. Approximately how many increased personnel does that represent?

Dr. JOHNSON. Counting half-time people as one-half it means 228 increase. Now, that is scientific men, scientists.

Mr. RABAUT. We will take up again at 2 o'clock. I want to say this. I have not asked any questions on this particular subject, physical research, and I intend to ask some questions. I want to question this $2,268,000. That is nothing new to us as it has been done before. When we set a dollar amount for a period of a year, and then people are put on the rolls for a part of the year, the entire amount allowed is used in that manner, thus increasing the number on the roll in the latter part of the year. It comes as a surprise to the Congress that that number of people are kept on the rolls for the entire following year, because the amount allowed was intended to be for employment for a full year. It was not intended that the entire sum for a year's employment be used for only a section of the year, thereby increasing the next year's requirement to the surprise of the Congress. That seems to be what has happened here. It is not the first time it has happened.

It happened to me one time when I was in charge of the Library of Congress, when we built the new building. We allowed so much money to staff the new building. They came in. We will say the figure was $100,000. They came in the following year and said "We did not get into the building until the first of January, and we staffed it for $100,000. Now it will cost you $200,000 to staff the building for the next year with the same personnel."

I said to them, "You just have the privilege right now of firing half of them." That is what happened. The same thing has happened this year with another committee on the Hill. It is not the right thing, and we are going to take it up this afternoon at 2 o'clock.

AFTERNOON SESSION

Mr. RABAUT. The committee will come to order.

VALUE OF RESEARCH CONTRACTS

Dr. Johnson, following the remarks of Mr. Evins this morning, what is the total dollar value of the present research contracts now underway?

Dr. JOHNSON. Under the Research Division?

Mr. RABAUT. Under your jurisdiction.

Dr. JOHNSON. We have two types of contracts, Mr. Rabaut.

Mr. RABAUT. Both under your supervision?

Dr. JOHNSON. Yes.

Mr. RABAUT. All right.

Dr. JOHNSON. I would add this remark, that funds under my supervision only contribute to some of these large contracts. They are not exclusively contracts under the research program.

Mr. RABAUT. What is the value of them?

Dr. JOHNSON. What we call our on-site contracts, which would include our large research laboratories and the part that the Research Division contributes to them during 1957 was $41,636,000, and off site we have spent $19 million, making a total of $60,652,000.

Mr. RABAUT. That is the value?

Dr. JOHNSON. That is the value.

Mr. RABAUT. What other kind of contracts do you have?

Dr. JOHNSON. That is all.

Mr. RABAUT. Your figure for the year goes to $60 million?

Dr. JOHNSON. $60,652,000.

Mr. RABAUT. Do you have any contracts that are continuing, that run from year to year?

Dr. JOHNSON. Yes.

Mr. RABAUT. This is just the yearly cost here, the yearly expense?

Dr. JOHNSON. That is right.

Mr. RABAUT. Certainly the contracts must be worth more than you spend in 1 year.

Dr. JOHNSON. Our contracts are funded year by year. Some of our contracts run for a longer period of time, but they are funded year by year.

Mr. RABAUT. What is the maximum value of the contracts that you have under your jurisdiction, not the annual cost? Are they tight contracts or are they open end contracts?

Dr. JOHNSON. The funds are committed only for 1 year.

Mr. RABAUT. I understand that.

Dr. JOHNSON. There is no commitment, for example, except moral commitments, continuation of employment and so on, which would commit the Government to support these contracts at any level.

Mr. RABAUT. What is your idea of this figure, for instance, here set forth on page 121? You have set forth the figure for 1956 was $49 million plus, for 1958 it is $71 million. How do you regard those figures?

Dr. JOHNSON. Those are costs.

Mr. RABAUT. And they are costs under each year?

Dr. JOHNSON. That is right.

Mr. RABAUT. The value of your contracts is only equal to $60 million?

Dr. JOHNSON. This year, yes.

Mr. RABAUT. Your cost this year is $60 million?

Dr. JOHNSON. Yes.

Mr RABAUT The value of your contracts, are these contracts completed at the end of each year?

Dr JOHNSON. They are completed at the end of year as far as——

Mr. RABAUT. The money for that year is concerned?

Dr. JOHNSON. Yes.

Mr. RABAUT. What about the overall value of the contracts?

Mr. MCCARTHY. Mr. Chairman, for the Division of Research there is outstanding at the end of 1957, which should be added to the cost of $60.7 million, an amount for unliquidated obligations under those contracts of $12.6 million. So this amount should be added to the $60 million to get what I think you are looking for, the value of the contracts themselves.

Mr. RABAUT. Then you have it up to $72.6 million?

Mr. MCCARTHY. That is correct.

NUMBER OF RESEARCH CONTRACTS

Mr. RABAUT. How many individual contracts are involved in this total?

Dr. JOHNSON. I can give you that figure, as of April 20, 1957. There were 342 off-site contracts. In addition to that we contribute out of this program to the contracts at six large laboratories.

Mr. FIELDS. We term them national laboratories.

Mr. RABAUT. That includes all of them?

Dr. JOHNSON. That is as of April 20. There have been some added since then. It is 369 at the present time.

Mr. RABAUT. Is that the total now?

Mr. JOHNSON. The total.

Mr. RABAUT. The other was 342. Now it is 369.

Dr. JOHNSON. That is correct.

REVIEW OF CONTRACT PERFORMANCE

Mr. RABAUT. Now, what procedure do you have to monitor performance of these research contracts to assure this committee that we are getting our dollars' worth.

Dr. JOHNSON. Every contractor is visited periodically. We receive annual reports. The publications resulting from the research work are submitted for publication in the scientific journals, and when the question comes up as to whether or not to renew the contract, the record of the contractor is very carefully scrutinized.

Mr. RABAUT. What is the running relationship between your office now—the word for that is monitoring contracts. What is the running relationship between your office and these 375 contracts? You naturally will want to find out what is going on.

Dr. JOHNSON. That is right.

Mr. RABAUT. How much contract do you have? Who makes those contacts?

Dr. JOHNSON. My staff makes those contacts. I have 13 scientists on my staff.

Mr. RABAUT. Thirteen people are monitoring 375 contracts?

Dr. JOHNSON. That is correct.

Mr. RABAUT. They must be on roller skates or bicycles or something.

Dr. JOHNSON. Some of the smaller contractors do not get visited every year, but they get visited periodically.

Mr. RABAUT. When you say a smaller contractor, how much money would be involved in a smaller contract?

Dr. JOHNSON. Some of these are quite small. These distribute all the way between no funds at all, and, say, a million dollars a year.

Mr. RABAUT. A person that does not get visited at least once a year must have a contract that runs for more than a year.

Dr. JOHNSON. No.

Mr. RABAUT. That is what I was asking about before. If you don't visit him more than once a year, you can't be interested in him unless he has a contract that runs more than a year.

Dr. JOHNSON. The contracts get renewed sometimes.

Mr. RABAUT. You renew the contract even though you do not find out what is going on?

Dr. JOHNSON. The million-dollar-a-year contractors get visited frequently.

Mr. RABAUT. How much money is involved in the small contract?

Dr. JOHNSON. They run all the way from no funds at all up to a million dollars a year. Now, there are 96 contracts, and that is the largest number in any one category, in the range between $10,000 and $19,000. That would be a sort of median figure. $20,000 would be a sort of median figure. We have quite a number of less than $10,000. There are 48 that are then between $20,000 and $39,000, 18 between $40,000 and $49,000, 17 between $50,000 and $59,000 and so on.

Mr. RABAUT. That sort of answers my question about the small contracts.

VALUE OF SMALL CONTRACTS

Mr. TABER. I wonder how these small contracts can possibly pay out.

Mr. RABAUT. What does the small contract involve?

Dr. JOHNSON. I feel they are very rewarding. The small contract usually supports the work of a professor in a university with 1 or 2 graduate assistants plus 3 or 4 graduate students. They are to carry on research in a particular field which is outlined in a contract.

The contracts pay out not only in the scientific data that comes out, but also, sometimes the most important advances are made by research teams such as that. They also are the most important factor we have in this field for the training of students.

Mr. RABAUT. Is this a sort of a contributing sum to the money that they would get otherwise? You could not get the number of people you just mentioned for, say, the $10,000. So is it a contributing sum you are giving toward money they are getting probably from the university?

Dr. JOHNSON. That is right.

Mr. RABAUT. From these small contracts sometimes you gain some excellent information, is that right?

Dr. JOHNSON. That is correct.

Mr. RABUT. Where was the Nobelium discovered, in a small contract or big ones?

Dr. JOHNSON. That was discovered by an international team comprising some scientists from our Argonne Laboratory plus some scientists from England plus some other scientists from Sweden.

Mr. RABAUT. Were any of them supported by these funds?

Dr. JOHNSON. Yes. The group from Argonne was supported by these funds.

Mr. RABAUT. Well, that is a good point in your favor.

Mr. FIELDS. I understand, Mr. Chairman, there is quite a remarkable discovery at Columbia. I do not know if we have anything in support of that.

Dr. JOHNSON. Yes, we supported part of that. That concerned the mystical words that I recited to you at the start. It was a very important discovery.

REVIEW OF CONTRACT PERFORMANCE

Mr. RABAUT. What would you say the average visit of your contracts would be to these different scientific groups?

Dr. JOHNSON. It varies a good deal, Mr. Rabaut. Our larger contracts are visited 2 or 3 times a year, and we work very closely with them. If it is a half million dollar contract, it will be visited about three times a year by members of our staff and perhaps more frequently by members of the operations offices.

Mr. RABAUT. Now, you get reports from them, too?

Dr. JOHNSON. We get reports, that is correct.

Mr. RABAUT. Are there quite a number of reports during the year? For some there might be quite a few and some others not so many? Is that right?

Dr. JOHNSON. In the main we encourage the scientists to publish the results in the normal channels of publication, scientific journals. But if something outstanding happens they send us a short report of it so that we have the information weekly.

Mr. BOLAND. There is no basic research here?

Dr. JOHNSON. Some of these categories are basic. We do not attempt to distinguish between basic research and applied research.

DUPLICATION OF RESEARCH IN GOVERNMENT

Mr. BOLAND. Do you know whether or not any of the contracts that the AEC enters into is a duplication or overlapping of any contracts that the National Science Foundation or the NACA enters into with various institutions?

Dr. JOHNSON. We have a very close coordination with other agencies in Washington that are supporting research contracts. I would say that there is no undesirable duplication. Sometimes it is important to have two teams of scientists working in closely related fields.

NUMBERS OF TYPES OF RESEARCH CONTRACTS

Mr. BOLAND. The great majority of these contracts I presume are entered into with educational institutions?

Dr. JOHNSON. Yes, I can give you the figures exactly. I am sure I have that figure.

Mr. BURROWS. We have contracts with 88 universities.

Mr. FIELDS. I think we had better supply it for the record. It is a large number.

(The information follows:)

The Washington off-site research program as of June 30, 1957

	Number of contracting institutions	Number of contracts
Universities	88	337
Nonprofit institutions	8	11
Government	6	9
Total nonprofit institutions	102	357
Profit institutions	11	12
Grand total	113	369

Mr. BOLAND. In the category of high energy physics, the expenditure for 1958 is $15,169,000. How many individual contracts do you have in that particular category which would entail the expenditure of that sum of money? Was there any overlapping in that particular category? Why can't it be done with 20 instead of 77? I presume that the 77 contracts come up with very similar conclusions.

Dr. JOHNSON. I can go over the contractors with you if you like.

Mr. BOLAND. Is that a fair assumption, that where you have several contracts in high energy physics that the great majority of them will probably come up with the same conclusions? Are they studying the same thing?

Dr. JOHNSON. No, they have different types of facilities and are approaching perhaps the same problem with different equipment, so that it takes the entire effort to get the full answer.

Mr. FIELDS. I believe the 77 is for physics. It is not broken down as to high energy physics.

Mr. BOLAND. That is the only category here which even mentions physics on page 121.

Mr. FIELDS. The third category is physics, and the fourth is, too.

Dr. JOHNSON. There are 20 institutions with whom we contract directly for research in high energy physics.

Mr. BOLAND. How do the institutions get a contract? Do you seek out the institution, or does the institution seek you out?

Dr. JOHNSON. As a rule they seek us out.

NUMBER OF RESEARCH PROPOSALS DENIED

Mr. BOLAND. Do you ever turn any of them down?

Dr. JOHNSON. Yes.

Mr. BOLAND. How many applications have you had for contracts that have been turned down or how many applications—what is the average annual request for contracts?

Dr. JOHNSON. I would have to get you the precise figures.

Mr. BOLAND. You may supply that for the record.

(The information follows:)

During fiscal year 1957 the Division of Research received 443 proposals for new and renewed research projects in the field of the physical sciences. Of this amount, 88 proposals were rejected after a technical evaluation, and 345 were approved. In addition to the above proposals, the Division receives each year a number of proposals informally that are rejected before a formal proposal can be submitted. A fair estimate of the number of proposals that are rejected in this manner each year would be about 60.

Mr. BOLAND. A program of this kind presents an opportunity for overlapping, I am glad to hear you say that such is not so, and that it is checked rather carefully, and that there is not too much duplication. I think that is one of the problems we have in Government in a lot of the agencies, particularly on contracts with institutions and other private sources. There is a great danger of waste and duplication. That is one thing we should avoid. I am glad to hear you say you are avoiding it.

PROCEDURE FOR APPROVING RESEARCH PROPOSALS

Mr. RABAUT. What procedure do you follow in the approval of proposed research contracts?

Dr. JOHNSON. Projects usually come to us as proposals from the research team that wants to engage in the work. It is usually a proposal in the field of competence of the individual involved, and work that we would like to do. They would not propose it to us if they did not think it related to our program.

We examine the proposal to see if it is in the field of our interest, and then as a rule we submit this proposal to a jury of 4, 5, or 6 competent scientists in the field. These scientists are picked for the review of the particular proposal on the grounds of their own competence. They are not a permanent committee or anything of that sort. We send these out through the mail to this jury of eminent scientists in the field. On the basis of their recommendations we either award a contract or reject the proposal. This of course assumes that we have the funds for doing it.

Mr. RABAUT. Is the scientific group that advises you about reactors in this group?

Dr. JOHNSON. We do not support any work on reactor development under this program.

Mr. RABAUT. That is under a different program.

Dr. JOHNSON. That is under the program of the Reactor Development Division.

Mr. RABAUT. What program are they under?

Mr. FIELDS. Do you mean the Committee on Reactor Safeguards?

Mr. RABAUT. Yes.

Mr. FIELDS. The Committee on Reactor Safeguards is an advisory committee that reports to me.

Mr. RABAUT. Do they get any funds from the program?

Mr. FIELDS. They are on consultant contracts.

Mr. RABAUT. Per diem?

Mr. FIELDS. Yes, sir, per diem. The amount varies with the particular individuals, but it is of the order of $50 a day for the time they work.

Dr. JOHNSON. It may be of interest to you to know that the scientists that we pick for review of these proposals do not charge us any fees for doing so. This is a gratis service.

EFFECT OF HOLDING RESEARCH PROGRAM TO 1957

Mr. RABAUT. Specifically, how would advancements in bringing the benefits of this new science to mankind be set back if the program were held to the 1957 level?

Dr. JOHNSON. That is a question I would hate to have to answer. I think it would set it back more than the funds involved, because morale is a very important factor in research. Our teams of scientists have gone ahead with enthusiasm and are hopeful that the Federal Government would see that this was a good thing to do.

Mr. RABAUT. It is enthusiasm to the taxpayers, because of the increase of $10 million.

Dr. JOHNSON. I would like to point out, though, that this is an activity of great benefit to the national interest. In the first place, the scientific progress made will underlie our future technological developments and contribute to the welfare of the American people. In the second place, I think the scientific prestige that we gain by being the foremost nation in science is getting to be an important factor in world politics. In the third place, the people that are trained under this program are a great bulwark for defense against aggression, as was proven in the last war.

AMOUNT REQUESTED FOR CONTINUATION OF 1957 LEVELS

Mr. RABAUT. What was the wording used for—you have it here and I am quoting from page 120—continuation in fiscal 1958 of expanded efforts initiated in fiscal 1957, and the figure is $2,268,000. What was the figure last year, and where is it? What did you call it last year?

Dr. JOHNSON. Mr. Rabaut, I explained that that figure is a sort of catchall figure which covers the categories that are not otherwise specifically designated.

Mr. RABAUT. What categories would it cover? The employment of people?

Dr. JOHNSON. The categories are listed on page 121.

Mr. RABAUT. That is what I am looking for.

Dr. JOHNSON. You see, item No. 2 there, "High energy physics," is specifically broken out in this first chart. The increase for that category is $2,239,000. Chemical properties is broken out. Computer development and so on. There are a number that are not broken down. This $2,268,000 represents increases in all those other categories on page 121 which are not specifically listed here in the first chart and it represents what is required to keep the program going at its presently planned level.

Mr. RABAUT. I tell you, Doctor, that is entirely too vague a proposition here to be put before Congress for the sum of $2 million. I know we deal in huge figures here, but this is $2 million. Anybody in the room would be darn glad to have it. It is just too vague an idea. We do not know where it is going. You could come in with this sort of thing every year and say "over and above what we had last year," and give us another new name that you are using for catchalls, and finally we would have it up to $50 million. Nobody would know what they were. That is not right.

Dr. JOHNSON. I agree with you, but the exact amounts requested are listed on page 121, and the justification for them is explained in detail in the following pages.

Mr. RABAUT. What was the figure last year that we had for this item?

Mr. MCCARTHY. There was no amount for this last year, Mr. Chairman. What that first item in this table on page 120 purports to show is the increase required to maintain the rate of effort that Dr. Johnson felt he would be at.

On the following page, the specific amount of increase for each category is shown.

Mr. RABAUT. You take this table here on page 121. You have $71 million and you have $60 million.

Mr. MCCARTHY. The difference is $10,348,000. It is the same amount as appears on page 120.

Mr. RABAUT. The difference between this $60,652,000 and $71 million flat gives you this $10,348,000. It is found in all these figures, numbering 15 categories, some of it is in each of them.

Mr. MCCARTHY. That is right.

Mr. RABAUT. That is a kind of new way of presenting something to the Congress.

Dr. JOHNSON. The first table is a sort of summary.

Mr. RABAUT. Suppose for instance under the figures for last year, namely, $60,652,000, you put on some new personnel or you put on some particular new contract for a period of 3 months, and now you are continuing that contract for a period of a year. That would show up in a deal like this. It is something then where the Congress is getting committed to do things in the future that it has no information about. I don't know how many different categories there are here in this, but it is not the regular procedure. I think you know that.

Mr. MCCARTHY. This was an attempt, Mr. Chairman, to break out the reasons for the increase in summary form.

Mr. RABAUT. It is not the way we are accustomed to receiving it.

Mr. MCCARTHY. The detail is shown on the next page.

Mr. RABAUT. You mean page 121?

Mr. MCCARTHY. Yes, sir.

Mr. RABAUT. It is shown in a way. Page 120 says "Continuation in the fiscal 1958 of expanded effort initiated in the fiscal 1957," and then it gives the figure of $2 million plus. That is all the information we have there. On page 121 we have a breakdown of 15 items that give us the actual for 1956 of $49 million plus, the estimate for 1957 of $60 million plus, and the estimates for 1958 of $71 million. The difference between the estimates of 1957 and 1958 constitute this sum of $2 million plus as referred to on the preceding page. Now, that is not the regular way to do it. Take, for instance, this item, "Production, treatment, and properties of materials," that has increased from $2,052,000 to $2,411,000. Where is that broken down?

Dr. JOHNSON. That is explained on page 129, sir.

Mr. RABAUT. Now, this is devoted to research and development on metals, alloys and ceramics that are of special interest to the Atomic Energy Commission. That evidently calls for more personnel; is that right?

Mr. MCCARTHY. On the new projects; yes, sir.

Mr. RABAUT. Now, that new personnel certainly was not put on the first day of the new year. It might have been put on in the last month of the year. Then it shows up in the next year as a big increase because it goes on for the full year. That is where they get around the appropriations that Congress makes them the year before.

Now, how much of that, for instance, is done in these 15 items that are recited here on page 121?

Mr. MCCARTHY. What you have generally, Mr. Chairman, is that these contracts are let at various times during the year. You will have attained at the end of the year a rate of effort in the research program. What this purports to show, and under each one of our categories we try to point it out, is how much of the increase represents a continuation of the effort at the end of the prior year, and how much is for the new projects contemplated. I think if you will look at the bottom of page 129 you will see that of the increase of $359,000 for 1958, $156,000 represents the continuation in 1958 of the expanded effort initiated in 1957. The balance then represents new items coming into the program.

Mr. RABAUT. What you are doing here is just commiting us in 1957 to finance something over and above that in the following years. That is all you are doing. You are doing the same thing that the people in the Library of Congress tried to do to me once.

Mr. MCCARTHY. These are not all people, sir.

Mr. RABAUT. I do not say it is all people, but it is $2 million plus. What should have been done here, if we gave you that money for fiscal 1957, you should have used such portion of it for the time allowed during 1957 and say to us we did not use all the money in 1957 because we put people on for less than a full year. Instead you do it for shorter periods in 1957 and commit us to a greater bill for the following years. That is what is being done here.

Mr. MCCARTHY. Mr. Chairman, I don't think we used it for shorter periods. Most of our contracts are for a full year.

Mr. RABAUT. You could not put everybody on the first day of the year.

Mr. MCCARTHY. That is correct. I say the contracts were let at various periods during the year.

Mr. RABAUT. This thing could grow to a mountain. The next year you will do the same thing.

Dr. JOHNSON. You notice this $60 million we spent this year is less than was appropriated.

Mr. RABAUT. Yes. You are going to carry it over. We are not taking anything away from you. But the point is that we don't want to get committed too deeply into the future. I am sounding off because this is the beginning of a new year—I don't know if it has been going on in the past. If it has I did not catch it. Don't forget about it.

Mr. FIELDS. No, sir.

EFFECT OF HOLDING RESEARCH PROGRAM TO 1957 LEVEL

Mr. RABAUT. Please give us for the record a schedule showing which programs should be reduced and in what amounts to hold the total program to the current level of $60,652,000. You can supply that for the record.

Mr. FIELDS. Mr. Chairman, we will attempt to do that. If we hold to the same amount it will result in less research work than in fiscal 1957 because of increased costs.

Mr. RABAUT. I am not against research work but I am very anxious to become informed. Sometimes when you are not informed it pays to hie them up a little bit and then they find out that the Congress has to become informed. You supply that for the record and we will take a look at it.

Mr. FIELDS. Yes, sir.

(The information follows:)

An analysis of the effect of holding to the fiscal year 1957 cost level indicates that not only would pressing basic research expansions be curtailed, but that severe cutbacks in the current program would be required. In this connection the research program is currently at an annual rate of $63.0 million, slightly under the amount approved by Congress for fiscal year 1957. Accordingly it would require $3.0 million over fiscal year 1957 costs of $60.6 million to maintain our current program level in fiscal year 1958.

The effects of the $10.3 million reduction to hold to the 1957 cost level are as follows:

Reductions necessary to hold to fiscal year 1957 level

[In thousands]

	Fiscal year 1957 estimate	Fiscal year 1958 estimate	Increases requested over fiscal year 1957	Reductions from fiscal year 1958 request which would be required to hold to fiscal year 1957 level
Isotope process development	$356	$370	$14	0
High energy physics	12,930	15,169	2,239	−$802
Nuclear structure and neutron physics	10,631	12,084	1,453	−646
Extra nuclear properties of matter	683	742	59	0
Design and development of devices for physics research	3,377	3,560	183	−1,882
Physical methods of isotope separation	570	595	25	0
Computer development and mathematics research	979	2,000	1,021	−1,100
Process chemistry	4,877	5,507	630	−780
Classified project A	1,199	1,410	211	−201
Chemical properties and reactions	11,889	13,973	2,084	−1,986
Chemical isotope separation studies	532	560	28	0
Production, treatment, and properties of materials	2,052	2,411	359	−427
Alloy theory and the nature of solids	3,443	3,859	416	−345
Effects of irradiation on materials	1,170	1,560	390	−393
Equipment not included in construction projects	5,964	7,200	1,236	−1,786
Total physical research	60,652	71,000	10,348	−10,348

It should be noted that the reductions which would have to be made are not in all cases comparable to the increases requested in the various activities. This takes into account the necessity for maintaining a balance between the various activities of the program to be most responsive to the Commission's current and future requirements. This is further explained in the analysis of the effects of such reductions set forth below:

High energy physics.—A reduction in this activity would prevent maximum utilization of high energy physics research facilities such as the cosmotron and bevatron, and would curtail initiation of programs to use high energy machines now under construction at Cambridge and Princeton.

Nuclear structure and neutron physics.—Programs fundamental to atomic technology planned and started in fiscal year 1957 could not be carried through.

Design and development of devices for physics research.—The reduction shown for this activity would not permit the forward planning necessary to hold our lead in high energy physics research.

Computer development and mathematics research.—This program began in fiscal year 1957 to develop advanced computers for Atomic Energy Commission use would have to be seriously curtailed.

Process chemistry.—Planned increases and current work for investigation of fluoride volatility and metallex processes required in connection with the production and raw materials programs, and the power reactor field would be eliminated. Some of the increase planned for classified Projects Mice and Bats would be forgone. New effort for recovery of research amounts of protactinium, neptunium, and americium could not be undertaken.

Classified project A.—Cost increases would require a reduction in the current effort for this classified program of great interest to the Nation's defense.

Chemical properties and reactions.—Planned increases and current effort in the fields of high-temperature chemistry, radiation chemistry, and nuclear chemistry would be eliminated as will some fundamental work related to corrosion phenomena.

Production, treatment and properties of materials.—Programs on corrosion, ceramics, plutonium metallurgy, niobium research, and pure materials that should be expanded in fiscal year 1958 would have to be cut below current levels.

Alloy theory and the nature of solids.—Planned expansion of current programs on high-temperature metallurgy, physical metallurgy and solid state physics relevant to new and improved reactors and weapons would have to be curtailed.

Effects of irradiations on materials.—Planned expansion on the effects of irradiation on reactor fuels and other materials of considerable interest to the Commission could not be undertaken.

Equipment not included in construction projects.—Support of a vigorous research program requires that adequate equipment be available, particularly in the field of high-energy physics research. A reduction in this activity would eliminate the purchase of any new machines and would also reduce below the current level the equipment requirements at the several national laboratories.

PRODUCTION, TREATMENT, AND PROPERTIES OF MATERIALS

Mr. RABAUT. With respect to item 12, production, treatment, and properties of materials, is private enterprise doing a similar type of research?

Dr. JOHNSON. They are, and they are doing it extensively and finding it very profitable in their own business. We are doing this in the atomic energy business at a level which is not inconsistent with that which private enterprise is doing in connection with their businesses.

Mr. RABAUT. This is for $2,411,000. How much money did you have for that last year?

Mr. FIELDS. $2,052,000 is the figure I have.

Mr. RABAUT. It is up $150,000.

Dr. JOHNSON. $359,000.

Mr. RABAUT. Do you not have any chance to taper off in this project, too, or do you figure if industry is doing it, it is going to cost you——

Dr. JOHNSON. What industry is doing is not helping us here. This is in the field of uranium, thorium, and other metals that are used in the atomic energy business. Now, industry is finding work of this kind to be the most rewarding research that they are doing.

Mr. RABAUT. Who are they doing it for?

Dr. JOHNSON. They are working on different materials.

Mr. RABAUT. You say they are finding it very remunerative.

Dr. JOHNSON. They are. We find much of the research program like Westinghouse and General Electric is in the materials field. There are a lot of different kinds of materials. Things that they are working with are not the kinds of things that we are working with.

Mr. RABAUT. Would you like to give a little example to us?

Dr. JOHNSON. Yes. The Bell Laboratories, for example, have a tremendous research program going on in germanium, because germanium is useful in electronic devices like transistors. They use them as hearing aids and so forth. We have no work of that kind going on in our program. But we are experimenting with uranium and thorium, things that we have to put into the reactors. We have to study what is the most suitable alloy and how radiation affects these things.

Mr. RABAUT. Do you feel assured in your own mind that there is not a lot of duplication going on here?

Dr. JOHNSON. I know there is not. I keep closely in touch with these people.

EQUIPMENT NOT INCLUDED IN CONSTRUCTION PROJECTS

Mr. RABAUT. All right. We are glad to have your word for it. This year on page 131 you gave a breakdown of equipment by laboratories. Last year it was by operations offices. This appears to be another device for confusing the committee. Perhaps for the record you could give a detailed breakdown showing the kind of equipment that is going to each separate organizational office or laboratory and what amounts for both years 1957 and 1958. Do you want to supply that?

Dr. JOHNSON. Yes, sir.

Mr. FIELDS. These laboratories are the users of the equipment and are under the jurisdiction of certain operations offices. Our requirements were presented in terms of operations offices last year. The equipment still is used in the same places. We will reconcile the table to provide the fiscal year 1958 data by operations office.

Mr. RABAUT. You mean it is still going to San Francisco, Oak Ridge, Washington, New York, Chicago, Schenectady?

Mr. FIELDS. Yes. For instance, the University of California Radiation Laboratory listed here for equipment on page 131 is under the San Francisco operations office.

Mr. RABAUT. You give us the tabulation we ask for and that will keep us satisfied, or else further disturb us.

(The information follows:)

Breakdown of equipment costs by type and office for fiscal year 1958

[In thousands]

Type of equipment	Location						
	Oak Ridge	New York	San Francisco	Chicago	Schenectady	Washington	Total
Laboratory	$1,070	$1,006	$1,205	$756	$20	$723	$4,780
Office furniture	46	48	65	39			198
Reactor and accelerator	412	0	500			500	1,412
Shop	136	60	100	45			341
Motor vehicle	69	32		6			107
Heavy mobile	27	30					57
Process	205	0					205
Miscellaneous	35	10	30	25			100
Total	2,000	1,186	1,900	871	20	1,223	7,200

PREPARATION OF SUMMARY TABLE OF INCREASES

Mr. TABER. I have 1 or 2 questions. Why was it that you made that table on page 121 so that that did not jibe with the table on page 120?

Mr. MCCARTHY. Mr. Taber, the table on page 121 is the way we have always presented the program. The table on page 120 was simply an attempt to provide a summary explanation of the increases by general categories. The full justification on the following pages relates to the table on page 121. What we are trying to show on page 120 is simply the increase required in fiscal year 1958 solely to continue the rate attained at the end of fiscal year 1957. In other words, if you would take your 1957 cost plus the increase of $2,268,000 you would continue your program at that rate in 1958.

Now, under each of the categories shown on page 121, we explain in the justification that follows what the new projects are.

Mr. TABER. That leads us to believe you are not being frank with us.

Mr. MCCARTHY. As I say this was simply an attempt to summarize. I think it did probably confuse rather than help the justification, but the justification does spell out beginning on page 121 all the items summarized on the table on page 121.

Mr. TABER. Is $60,658,000 approximately the amount that was spent in 1957?

Mr. MCCARTHY. Yes, sir. This amount was revised from what we estimated in the 1957 budget to reflect the actual amount as we now see it.

Mr. TABER. You seem to have it set at a level of increase approximating $11 million. In 1957 it was 11. You are asking in 1958 for 10½.

Mr. MCCARTHY. I think the increase in 1957 over 1956 was approximately the same also.

Mr. RABAUT. Are you talking about pages 120 and 121?

Mr. TABER. Yes.

Mr. RABAUT. I have asked for a table on that showing individual items that add up to the 10,348,000 in showing where the $2,268,000 comes in.

AVAILABILITY OF SCIENTISTS

Mr. TABER. Do you have scientists in the market for a job that are available to fill these new positions that you are creating?

Dr. JOHNSON. Yes, sir. We have plenty, and we can make a good selection and take only the best.

PREPARATION OF SUMMARY TABLE ON INCREASES

Mr. FENTON. As I figure it out, that first item you have on page 120, and the breakdown on page 121 is limited to 7 out of the 15 items there, is that right?

Dr. JOHNSON. Something like that.

Mr. FENTON. In other words, you have itemized on pages 120 and 121 high energy physics, equipment not included in construction, chemical properties and reactions, computer development and mathematics research, nuclear structure and neutron physics, process chemistry, and alloy theory and nature of solids. Those are the things that you seem to have itemized over on 121 separately.

Mr. MCCARTHY. On 120 we tried to summarize the major ones.

Mr. FENTON. $2,268,000 is included in the isotope program, and design and development of devices for physics research?

Mr. MCCARTHY. That is correct, sir. We have broken it down in more detail on the pages following 121.

Dr. JOHNSON. The last paragraph in each of the detailed justifications on the pages that follow give the amounts which when added together would make that $2,268,000 in the first item on page 120.

Mr. MCCARTHY. In the table we submit for the record we will show the two columns as to where the extension came from.

MANNER IN WHICH COST LEVELS OF CATEGORIES ARE DETERMINED

Mr. FENTON. How are the levels of the various programs under this heading determined, Doctor?

Dr. JOHNSON. By the promise of the work that is going on and the importance that we attribute to the project. We take the money we have and distribute it the best we can to get the most from it.

ISOTOPE PROGRAM

Mr. FENTON. Will you elaborate a little on the radioisotopes?

Dr. JOHNSON. Yes, sir. The isotope program is detailed on pages 121 and 133. This $370,000 which we are requesting for process development is needed to improve the processes by which materials are radiated in the reactor to make them radioactive and then for chemical processing afterward to put them in package form for distribution to the user. That is a continuing research and development program to bring out new types of radioisotopes and to improve and reduce the costs of present processes. Now, the cost of producing and distributing radioisotopes is $2,351,000, plus $621,000 for the stable isotopes, for a total of $2,972,000. Now, the sales and credits to the radioisotopes program from our own laboratories for their use of isotopes amounts to more than the production costs. If you add $657,000 for distribution credits for radioisotopes, and $2,178,000 for sales, one comes up with

a figure substantially larger than $2,351,000. If there is any excess, it gets used in the program.

Mr. FENTON. What is the difference between your radioisotopes and your stable isotopes?

Dr. JOHNSON. An element like uranium or iron has a number of different kinds of nuclei. We have among the natural elements 92 but there are about a thousand different kinds of nuclei associated with those 92 elements. Now, some of these different kinds of nuclei, all associated with the same elements, are radioactive and some of them are stable. The radioactive ones are of course of short life. They are transitory in nature. They are produced in the reactor and they have the property of giving off radiation, but when they give off this radiation they revert to other forms which may be stable or it may be some other radioactive form.

Mr. FENTON. Thank you. That is all, Mr. Chairman.

BIOLOGY AND MEDICINE PROGRAM

Mr. RABAUT. Now we will take up biology and medicine. We will insert pages 136 through 154 in the record.

(The justification follows:)

BIOLOGY AND MEDICINE PROGRAM—OPERATING COSTS

Program statement

Estimate fiscal year 1958	$36,000,000
Estimate fiscal year 1957	31,598,000
Increase	4,402,000

With the substantial growth and development of civilian and industrial utilization of atomic energy with little or no diminution of nuclear-weapons requirements, the biology and medicine program is faced with the need for increasing the tempo of research efforts in the area of radiation protection and hazard evaluation, as well as in the exploration of beneficial uses. Meanwhile, the primary research and operating activities in the program are concentrated on the problems associated with the protection of the workers and the populace as a whole from the hazards inherent in atomic-energy activities.

There are summarized below certain of the programmatic additions or expansions required to accomplish the planned objectives.

1. Substantially increased research efforts in projects involving oceanography, ecology, meterology, and marine biology, wherein information is badly needed for the solution of problems of radiation hazards associated with fallout from weapons testing or atomic-plant operations and the disposition of radioactive wastes.

2. Increasing emphasis will be placed on research studies leading toward a much better understanding of the genetic effects of radiation on human populations. The need for increased effort in this area is sharply attested to in the 1956 reports on the biological effects of radiation published by the United States National Academy of Sciences and the British Medical Research Council.

3. The program of the Atomic Bomb Casualty Commission in Japan at Hiroshima and Nagasaki will be strengthened to take further advantage of this unique human population for the study of long-term radiation effects.

4. The program provides for increased participation by the scientific talent available in our universities and hospitals in the further development of the beneficial uses of atomic energy, as well as in the solution of the problems mentioned above.

5. Civil effects test activities continue to be an important function of the program and, during fiscal year 1958, projects designed to test in the field a variety of shielding situations as they effect physical and biological damage will be continued.

6. This budget estimate provides for fulfillment of staff requirements, particularly at the Brookhaven National Laboratory, with the anticipated completion of the new medical center there, and covers increased costs of research already experienced at the several national laboratories supported by the program.

It becomes increasingly apparent that the rapid growth of civilian uses of atomic energy must be accompanied by a similar rapid advancement in our scientific knowledge of the potential immediate and long-range hazards and the development of countermeasures thereto. To maintain our lead, the program can neither become stagnant nor static. To this end, the budget estimate for fiscal year 1958 sets forth a request for approximately $24,175,000 for biomedical research projects to be conducted in 16 Commission-operated laboratories and $11,825,000 to provide for support of research at approximately 500 individual university, hospital, and other institution projects.

The total program budget for fiscal year 1958 provides for an increase over fiscal year 1957 of $4,402,000.

Summary of estimates by category

Category	Actual, fiscal year 1956	Estimates, fiscal year 1957	Estimates, fiscal year 1958
1. Radiation effects on biological systems	$9,526,918	$10,552,000	$11,795,000
2. Combating radiation detrimental effects	1,918,395	1,980,000	2,233,000
3. Beneficial applications of atomic energy	8,484,675	8,978,000	9,796,000
4. Biomedical problems in atomic-energy operation	5,346,404	6,687,000	8,080,000
5. Dosimetry and instrumentation	2,228,629	2,329,000	2,761,000
6. Equipment not included in construction projects	866,502	1,072,000	1,335,000
Total biology and medicine program	28,371,523	31,598,000	36,000,000

JUSTIFICATION OF CATEGORIES

1. Radiation effects on biological systems, $11,795,000

(*a*) *Medical research: fiscal year 1957, $5,005,000; fiscal year 1958, $5,493,000.*—Much of the increase in the fiscal year 1958 budget in this category will go to the expansion of the Brookhaven program, in anticipation of the new medical center, on studies of the distribution of radioactive materials in various metabolic pathways, and exploration of new and improved methods for utilizing neutron-capture therapy for treatment of cancer. The remainder of the budgetary increase will be used to exploit the numerous advances in other fields, some of which are indicated below.

A successful system has been developed for keeping the spleen alive and functioning normally for many hours, thus enabling more precise observation of radiation effects on lymphocytes under relatively normal conditions. This is of considerable importance because lymphocytes (a type of white blood cell) are the most sensitive of the body's tissue to radiation.

New data have been secured in the study of a little-understood blood substance mucoprotein, under the influence of radiation. It is anticipated that future work in this field may yield important information on the source of hemorrhages in the radiation syndrome.

Major progress has been made in the elucidation of the detailed steps in the manufacture of hemoglobin, the oxygen-carrying red pigment present in red blood cells. It has been discovered tetronic acid causes a marked increase in the production of hemoglobin; this work will be carried forward as an important part of both the theoretical and practical aspects of the understanding of radiation damage to blood-forming tissue.

It is now well substantiated that the appearance of bilobed lymphocytes (white blood cells with a double or dumbbell-shaped nucleus) is the most sensitive indicator for radiation exposure in humans. Significant progress has been made in translating this important observation into a useful radiation-monitoring procedure by the development of a new technique for collecting these abnormal lymphocytes on a sand filter.

Recent studies have advanced our knowledge of radiation-produced changes in the character of blood lipoproteins (molecules of combined protein and fat). This is of particular interest because of the analogous changes observed in various diseases involving fat metabolism, such as arteriosclerosis. It is anticipated that further studies on this observation will have an important bearing on both

the nature of radiation damage and the metabolic disturbances underlying the development of arteriosclerotic heart disease.

Studies by the Atomic Bomb Casualty Commission on persons exposed to the atomic blast at Hiroshima and Nagasaki have continued to yield important data. It has been established that to date no diseases related to radiation, other than leukemia and cataracts, have been observed in the adult population radiated by the atomic bomb. However, the death rate amongst this group appears to be somewhat higher than the nonexposed population which has recently moved into these cities. A considerably expanded epidemiology study of this problem will be well underway in fiscal year 1958. This observation is of great importance because of its bearing on the nonspecific effect of radiation in shortening life span of animals. Likewise, new cases of leukemia amongst the exposed Japanese are being documented in an effort to determine the ultimate incidence of this form of blood cancer in exposed persons.

(*b*) *Biological research: Fiscal year 1957, $5,320,000; fiscal year 1958, $5,964,000.*—One of the principal objectives under this category is to obtain critical information upon which more accurate estimates of the genetic effects of radiation on human populations can be based. The reports issued on June 12, 1956, by the National Academy of Sciences and by the British Medical Research Council, in which such estimates were attempted, have emphasized the areas in which additional information is needed. Estimates of genetic damage are essential for the establishment of "permissible" levels of radiation to which individuals and populations can be exposed.

Radiation-induced genetic effects can be assessed either by estimates of the frequency of genetic conditions expressed in the immediate offspring of individuals exposed to radiations, or by estimates of effects on ensuing generations. Improved evaluation of the more immediate genetic effects of radiation is foreseen from the program here outlined. It is recognized that the more persistent long-term effects on human populations will require many years of study. Areas in which additional information is needed for these evaluations include: (*a*) variation in rates of spontaneous and induced mutation associated with different species, with different stages in development, and under different physiological conditions; (*b*) the extent of genetic as opposed to environmental components in the expression of inherited traits; (*c*) frequencies of deleterious genes already carried in the human population; and (*d*) rates at which deleterious genes accumulate and are eliminated in successive generations in populations.

A second objective of our genetic studies is to obtain information about the chemical and structural nature of the genic material and the precise way in which these are changed by radiation. This sort of information is essential for attempting to control or ameliorate the effects of radiation. In fiscal year 1958 increased emphasis will be placed on determinations of mutation rates at low levels of exposure; comparisons between effects of acute and chronic radiation; determinations of mutation rates in human cells in tissue culture; and determinations of gene frequencies in human populations.

Also included is an ecological program designed to study biological systems comprised of plant and animal populations, natural and/or cultivated, in terrestrial habitats above and beneath the substrate, and in aquatic situations, both fresh water and marine, and to relate environment to their behavior in terms of soils, water, and atmospheric factors, and the interrelations of plants and animals with each other. The objectives are (1) to evaluate the effects of radiation on the broader biological processes of biotic assemblages in land and water such as migrations and establishment, competition, survival, and succession; territorial behavior and controls; food chains and webs; environmental systems, both regional and local. (2) To determine natural conditions in plant and animal communities and/or background to better evaluate the extent of accumulated contamination and its longtime effects. (3) To contribute significant data of a biological nature to aid in the selection of sites to be utilized for atomic energy activities.

The research effort in ecology includes: Studies of plant succession on radioactive soils, role of phosphorus in biological cycles in high mountain lakes, strontium distribution and accumulation in soils, and uptake by plants and animals; distribution of fallout materials near the test sites (continental and oceanic), effects of radiation on germination of forest tree seeds, accumulation and redistribution of radioactive materials in forest and cultivated land, uptake of radioactive materials by aquatic plants, effects of stream polution by radioactive wastes on adjacent vegetation, territorial behavior and migrations of animals, effects of radioactive fallout and wastes on food webs and chains on land and in water.

(c) Biophysics research: fiscal year 1957, $227,000; fiscal year 1958, $338,000.—Fundamental physical-chemical processes are the major part of this category—that is, the basic mechanisms by which radiant energy is absorbed by living tissue and exerts its biological effects. Further information is sought on the amount of energy needed to produce an ionizing event. Also, the number of such events along a given length of path (linear energy transfer) affects the intensity of the biological effect, so that further studies are being carried out on the linear energy transfer of alpha, beta and gamma rays and neutrons. Many biological effects, such as genetic changes, may occur through an intermediate radiochemical effect interposed between the ionizing and the biological event. Such processes may have a threshold effect, thus giving the animal or human body a high tolerance for low chronic doses of radiation. Conclusive evidence of this effect would have a marked influence on permissible exposure levels and on the cost of radiation protection. Studies on these intermediate effects, and on the basic mechanisms of cell injury, will be accelerated.

An important part of the study of radiation effects is how to get the most value from observed data. Two systems will be given increasing attention. "Information theory" has proved extremely useful in communication problems, and will be further investigated for its usefulness in radiobiology. Another system to be studied is "stochastic theory" which concerns itself with the art of deducing, with a high degree of validity, concepts of radiobiological processes which can only be studied indirectly.

2. *Combating radiation detrimental effects, $2,233,000*

(a) *Medical research: fiscal year 1957, $889,000; fiscal year 1958, $1,026,000.*—The fiscal year 1958 budgetary increase will be largely devoted to an expanded program in the procurement and testing of various blood factors which may be of importance in radiation protection.

Progress has been made in working out the chemical techniques for isolation of a radiation protective factor from bovine plasma. It is anticipated that the establishment of this phenomena will advance our knowledge of mechanisms which might be operative for protection against and treatment of radiation injury.

It is established that significantly beneficial effects have been achieved in modifying radiation death by the combined use of aureomycin and perihemin.

Significant advances have been made in the techniques for estimating by external counting the quantities of radioactive materials accumulated in the human body. This has been of particular use in the treatment of individuals accidentally exposed to radioactive materials. A vigorous program exploring the methods for removing isotopes deposited in the body is under study at a number of Commission projects and several methods for minimizing internal deposition of radioelements have been discovered. Likewise, the search for agents which bind isotopes and increase their excretion from the body is continuing. Recently a new chelating agent has been discovered which is 10 times more powerful than the best previously known compound. Studies on the excretion of isotopes from the human body have yielded mathematical analyses which will be of significant help in the general problem of management of cases of isotope poisoning.

(b) *Biological research; fiscal year 1957, $823,000; fiscal year 1958, $880,000.*—Studies completed recently have indicated that temporary recovery from ordinarily lethal doses of radiation can occur by replacement of bone marrow cells of an irradiated animal by cells from a normal donor animal. This work is being pursued very actively in animals and so far as is possible in man. This discovery demands that efforts to improve recovery of irradiated animals proceed along two lines: (1) Increased efforts to find solutions to the problems inherent in marrow preservation and transplantation; and (2) determination of the manner in which natural substances ameliorate the symptoms and signs of radiation damage. Methods of treating specific aspects of altered physiology and of pathology following irradiation will be emphasized, as well as investigation of general changes relating to long-term effects. Further searches will be made for detoxifying agents which are capable of accelerating removal of radioactive elements which have been ingested.

The search for new synthetic compounds which affect the sensitivity of animals and of bacteria to radiation will be further pursued. The mechanisms by which ionizing radiations damage cells and the subunits of cells and the reversal of this damage by natural and synthetic compounds and biological preparations will undergo continued investigation.

Increasing attention will be directed toward examining late effects in animals protected from acute death or which have recovered, by appropriate treatment, subsequent to otherwise fatal doses of radiation.

(c) *Biophysics research: fiscal year 1957, $268,000; fiscal year 1958, $327,000.*—This category includes identification and evaluation of radiation hazard associated with reactors, high-energy accelerators, teletherapy machines and other radiation sources, together with means for improving protective shielding of personnel against such sources of radiation. High-energy accelerators produce very penetrating gamma rays, neutrons, atomic and subatomic particles. Their detection and measurement will be further studied, as well as their behavior in matter as a basis for adequate shielding. The atomic mechanisms whereby beta and gamma rays are absorbed in various materials will be studied theoretically and experimentally as a means of improving shielding, both as to kind of material and geometrical configuration.

Studies will be conducted to provide better understanding of the scattering of radiation, and means for its shielding, around teletherapy and high voltage X-ray machines. This understanding is particularly needed in view of recently reduced permissible exposures to personnel.

3. Beneficial applications of atomic energy, $9,796,000

(a) *Cancer research: Fiscal year 1957, $3,012,000; fiscal year 1958, $3,299,000.*—The fiscal year 1958 increase will be largely divided between the expansion of the programs at the Argonne Cancer Research Hospital on isolation of the substance controlling red blood cell production and at Brookhaven National Laboratory on the brain tumor studies anticipating the availability of the new medical reactor in fiscal year 1959.

Major progress has been made in developing techniques for using antibodies against cancer cells as carriers of radioisotopes for selective irradiation of tumor tissue. The improvement has been made by producing selective paralysis in the capacity of normal tissues to concentrate radioactive antibodies, thereby allowing a much larger fraction to be deposited on cancer cells.

Two limited series of brain tumor patients treated with neutron radiation from the reactor at Brookhaven have recently been completed and extensive studies of the results are in progress. In the meantime, collateral research has been carried out to improve the concentration of boron in brain tissue and to minimize unwanted side reactions of the treatment. This work will be further pursued.

It has been determined that radiomanganese localizes to a useful extent in liver cancer and some promising results have been achieved in treatment of this type of tumor. This program is being vigorously prosecuted, especially in regard to minimizing associated radiation damage to the bone marrow produced by the radiomanganese in order that larger quantities can be deposited in the cancer tissue.

A very important discovery has been made on the mechanism for regulating production of red blood cells. A biological assay system has been developed which has detected the presence of a substance in blood capable of markedly increasing red blood cell production. Further extensive efforts will be made to isolate this material. The availability of such material in quantity may be of great importance in the treatment of anemias of cancer and other diseases as well as of studying the mechanisms of blood production, a matter which is essential to the problem of combating radiation effects.

A new development has been made, utilizing hormonal therapy, for improving the localization of radiophosphorus in bone tumors. This has resulted in a striking relief of pain in a number of patients. Several new radioactive rare earth isotopes have recently been evaluated with considerable promise for the treatment of fluid accumulation in the lung and abdomen resulting from cancer.

(b) *Medical research: Fiscal year 1957, $2,775,000; fiscal year 1958, $3,006,000.*—It is anticipated that in fiscal year 1958 the level of support for exploring the uses of radiation and radioisotopes as a tool in the study of diseased states will not increase significantly.

A number of major advances in this field have been recently made. A dye tagged with radioiodine (Rose Bengal) has been used to define the status of liver function and promises to be a useful clinical diagnostic procedure. A similar statement can be made for the use of radiodiodrast for kidney function.

With the availability of improved techniques for visualizing fluoroscopic images, studies are under way to utilize radioisotopes for the direct visualization of blood flow and through internal organs, such as the liver and heart.

The availability of the 340 Mev proton beam from the Berkeley cyclotron, which is capable of selectively destroying minute areas in the structures adjacent to the pituitary gland, has opened a new and very promising method of exploring the endocrine function of this important gland.

The method of activation analysis, which uses neutrons from atomic reactors, has greatly accelerated the study of the role of trace elements in normal metabolism.

Labeling of compounds which are built into body substances, such as proteins and hormones, has led to very significant advances in our knowledge of the detailed and complicated biochemical changes which occur in a variety of diseases.

(*c*) *Biological research: Fiscal year 1957, $2,724,000; fiscal year 1958, $2,974,000.*—The program in this category is designed to lead to the elucidation of life processes of terrestrial and aquatic organisms. Basic information in this field is essential for our understanding of the mechanism of radiation injury. This program is carefully integrated with the research conducted under the biomedical problems in atomic energy operations category described elsewhere in these estimates.

The biological effort in this field will include:

1. The movement of ions in soil, uptake by roots and foliage of nutrients and microelements, their transport and physiological function in plants. Work to date has shown that certain nutrient elements, both essential and fission products, are absorbed from the leaves and readily move to other parts of the plant, whereas other elements are poorly absorbed and are not transported. This information is essential to the effective utilization of fertilizers and plant supplements.

2. Recent isotope techniques developed in the laboratories are being utilized in the field to determine the essential nutrients, and rates of growth of aquatic and marine organisms at the various trophic levels. This quantitative, fundamental information is necessary to successfully measure the economic productivity of the rivers, lakes and seas during different seasons.

3. Methods of controlling many plant and animal diseases may be expected to be developed as a result of research using radioistopes. The metabolism and mechanism whereby some insecticides exert their toxic effects have been discovered by using radioactive insecticides. This technique has provided information on the possible toxicity of some insecticides and pesticides to humans.

4. Pathways of metabolism of organic compounds in plants and micro-organisms can provide basic information for extending similar studies to higher animals and to man. Metabolically deficient mutations induced by radiation have been especially valuable in determining the pathways of formation by plants of essential nutrients such as amino acids and vitamins.

5. Studies will be continued to evaluate the usefulness of radiation induced mutations in plant breeding programs. While some very useful mutations have already been produced by radiation, there are many areas in which information is incomplete, for example, the effectiveness of different kinds of radiation and stage of development of the plant at the time of radiation.

6. Knowledge of the mode of action of various plant growth stimulants (weedkillers) can be obtained through the use of radioisotopes. Such information may be expected to lead to increased yields of important food crops.

7. Much information has been obtained by using carbon 14, on the process of photosynthesis which is the method whereby plants in the presence of sunlight use carbon dioxide and water for the formation of carbohydrates and other nutrients essential to all animal life. Continued work in this field may be expected to lead to the complete elucidation of photosynthesis so that it might be accomplished chemically on a commercial scale.

8. Basic information concerning equilibria between biota and environment in land, sea, and fresh water habitats is essential to determine the rate and the extent to which agriculture, industry, and atomic energy activities can occupy a landscape with greater benefit than detriment.

9. In marine and aquatic biology new isotope techniques are being used in the field to determine how the large reservoir of inorganic nutrients in lake and river bottoms and sea can be made available to the algae, plankton, and subsequently the economically important food products.

(*d*) *Biophysics research: Fiscal year 1957, $17,000; fiscal year 1958, $17,000.*—Projects considering the mathematical interpretation of the behavior of isotopic tracers in biological studies are included in this budget category.

(*e*) *Distribution of radioisotopes under research support program: Fiscal year 1957, $450,000; fiscal year 1958, $500,000.*—This program provides for the distribution of radioisotopes for use in medical, biological, and agricultural research,

at a cost to the user of only 20 percent of established prices. The reduction of 80 percent of cost is borne by the Commission and is reflected in this budget estimate. The purpose of this program is to encourage and foster the use of radioisotopes in areas of beneficial research and to make such radioisotopes available at reasonable costs. It is anticipated that the demand will increase somewhat in fiscal year 1958 as knowledge of the existence of the program continues to spread and new methods are devised for the utilization of radioisotopes in biomedical and agricultural research.

4. Biomedical problems in atomic energy operations, $8,080,000

(a) Medical research: fiscal year 1957, $1,251,000; fiscal year 1958, $1,325,000.—A wide variety of toxic materials are under study, such as beryllium, uranium, thorium, a number of solvents and rare earth compounds. A considerable effort is being devoted to the study of radon gas because of its importance in uranium mining and milling. Beryllium is still a significant toxicological hazard because of the continued interest in the refining and fabrication of this metal for reactor components. There is an expanding effort in the study of deposition and removal of particles from the lungs because of urgent need for this type of information in establishing maximum permissible concentrations of airborne radioactive particulates. Studies of the effects of blast and thermal burns are being vigorously pursued in an effort to devise protective measures. In addition, an increasing number of short-term toxicological problems relating to specific situations in the industrial and weapons programs require prompt solution in order to expedite operations from which these problems arise.

Research under this category includes an expansion of projects to be pursued in connection with the test program including a pilot test to relate more precisely the Japanese radiation exposure data and a generally acceptable LD_{50} radiation dose, making use of simulated Japanese shielding conditions at the test site, with extensive physical dosimetry and possibly animal exposures; a program in the area of protective measures against fallout, including decontamination procedures, relative value of alternative building materials, structural configurations, etc., for optimum protection of our facilities and installations in event of nuclear attack; increased blast biology research, both laboratory and field, to develop criteria for personnel shelters acceptable biologically, as well as structurally.

(b) Biological research: fiscal year 1957, $1,989,000; fiscal year 1958, $2,074,000.—The major objective of this program is to understand the biological behavior and effects of fission products. Contamination of the atmosphere and landscape by materials from reactor operations, fuel testing, and the detonation of atomic weapons creates numerous biological problems of concern to the public and of significance to its welfare.

Research in this category is designed to (1) discover the effects of fission products on plants and animals in their environments, terrestrial and aquatic (fresh water and marine,) and (2) determine the amount of environmental contamination, its accumulation and/or its redistribution.

The research effort in this budget category includes (1) longtime studies of biotic populations in various kinds of habitats, contaminated and uncontaminated, in permenently reserved areas, with emphasis on ecological processes such as reproduction, growth, migration establishment and succession; (2) studies of the deposition, accumulation, redistribution, and the cycling of radioactive materials from places of deposition on land and sea to plants and/or animals to man.

As there are no completely isolated bodies of water existing in the sea, wastes from production reactors, nuclear tests or power reactors dumped into the sea ultimately spread to all parts of the world. In the field of marine and aquatic biology the program is designed to determine to what extent marine populations accumulate, concentrate, and excrete the fission or waste products and ultimately transfer them up the food chains. The excretion rates, internal distribution, and degree of toxicity to the organism per se of strontium 89, 90, strontium-yttrium, cesium 137, ruthenium, zinc 65, unseparated fission products, have been or are under investigation.

(c) Biophysics research: fiscal year 1957, $3,447,000; fiscal year 1958, $4,682,000.—The principal effort will be to monitor on a worldwide basis the radioactivity in soil, air, and water. This will include the development of radiochemical techniques for determining very low activities in these samples. In view of the worldwide importance of this problem, an increasing amount of staff effort will be devoted to assisting the programs of the United States

Scientific Committee on Effects of Atomic Radiation and of the International Geophysical Year. In consideration of the increasing tempo of weapons testing and atomic plant operations by various countries, the problems of international relations regarding the distribution and hazards of radioactive debris become increasingly important. It is anticipated that additional laboratory personnel and facilities will be devoted to analyzing samples for Sr–90, Cs–137, and other toxic radionuclides in man's environment. The major portion of the increase will provide for an enlarged program for determining the stratospheric burden of strontium 90 and other radionuclides.

The health physics program associated with Atomic Energy Commission facilities will continue to include, where necessary, studies of the diffusion of gases and radionuclides in the plant environs. Projects to study waste disposal techniques will aim at the control of liquid wastes economically without producing a situation that will be hazardous to the present or future generations. There is an increasing trend in the monitoring of radioactivity in the environs of atomic-energy plants, including soil, air, water, and buildings, toward using automatic equipment in place of manually operated equipment and instrumentation. Continued studies in the earth sciences will improve our knowledge of the flow of underground water, structure of underlying rocks and the nature of the soils which greatly influence the rate of diffusion and flow of radioactive wastes buried in the ground. Meteorology will be supported to determine the diffusion and dispersion of radioactivity in the atmosphere from weapons testing and in plant operations. Increasing emphasis will be placed on problems associated with disposal of very high radioactive wastes at sea and in inland waters. The problems associated with evaluation of the permissible dose level of toxic radioisotopes emanating from our plant operations and weapons testing will continue to be an important consideration in developing our research program under this category. Industrial hygiene problems associated with processing plants and mining operations such as hazards from radon, uranium, beryllium, plutonium will require continuing attention. Supporting research studies will be continued or initiated to provide information on the biological effects of these toxicants and to develop methods for reducing the hazards to personnel in plants processing these materials.

5. Dosimetry and Instrumentation, $2,761,000

(a) Dosimetry: Fiscal year 1957, $1,115,000; fiscal year 1958, $1,190,000.—

(b) Instrumentation: Fiscal year 1957, $1,214,000; fiscal year 1958, $1,571,000.—

The effects, both beneficial and detrimental, of ionizing radiation on living matter constitutes the basis for a substantial portion of the Commission's biomedical research program. Although the results of such radiation may be observed, it is essential to know which type and what amounts of radiation cause the observed effects. In order to determine the "what" and the "how much," measuring techniques (dosimetry) and sensing devices (instrumentation) must be designed, developed, and evaluated. These activities comprise this budget category.

During fiscal year 1958 improvement of techniques and procedures for absolute determination of tritium, strontium 90, yttrium 90, cesium 137, and radon in vivo will receive emphasis. Particular attention will be focused on the application of gamma ray scintillation spectroscopy to many of these determinations, and for routine monitoring of personnel. It is anticipated that wider application will be made of the microcalorimeter to measure the output of teletherapy machines and other radiation sources.

Emphasis will continue to be placed on the development of radiation detectors such as scintillation phospors, radiosensitive semiconductors, chemical dosimetric systems, etc., and on vital detection components, particularly multiplier phototubes. Research will continue to be supported at universities on the fundamentals of detection processes such as scintillation, and secondary emission from photocathodes. Completion of a unique beryllium dust monitor is anticipated, and development of quartz fiber instruments will be initiated.

Equipment not included in construction projects, $1,335,000

Equipment requirements for the biology and medicine program are estimated at $1,335,000 for fiscal year 1958, which represents an increase of $263,000 over fiscal year 1957. The increase is primarily for the expanded biomedical research

program. The major portion of the amount requested is for laboratory and shop equipment.

There follows a breakdown of the total equipment costs indicating amounts estimated for each major installation in relationship to its other operating costs under this program.

[In thousands]

Installation	Other operating costs	Equipment costs
Argonne Cancer Research Hospital	$1,607	$60
Argonne National Laboratory	3,000	170
Brookhaven National Laboratory	3,340	225
University of California Radiation Laboratory, Berkeley, Calif.	1,925	75
Oak Ridge National Laboratory	3,270	150
University of Rochester	1,456	50
Atomic Bomb Casualty Commission, Japan	1,800	50
Hanford Plant, General Electric Co.	1,520	80
All other	16,747	475
Total	34,665	1,335

Mr. RABAUT. Who is going to testify for this?

Mr. FIELDS. Dr. Dunham, Director of the Division of Biology and Medicine.

ON-SITE VERSUS OFF-SITE ACTIVITIES

Mr. RABAUT. Doctor, we are glad to have you before the committee. What amount of work is being done in this area by AEC or its contractors as compared with laboratories, schools, or organizations in no way associated with the Commission? Will you compare the work being done in AEC laboratories with the work being done under research contracts?

Dr. DUNHAM. About two-thirds of our operating funds provide for work at major national laboratories or in what we call our on-site activities in Government-owned buildings with Government-owned equipment. About one-third is at university laboratories, hospitals, and independent research laboratories. In general, the long-term projects and projects which can only be carried on in relation to reactors or other special equipment which happens to be present at a national laboratory are carried on at the national laboratories. The work we support at the universities is done with more conventional, standard equipment and consequently, although not less important in nature, can be done by university scientists in their existing facilities.

Mr. RABAUT. What did you say about the amount of work?

Dr. DUNHAM. About two-thirds of our funds are spent at our on-site activities. About one-third at universities, medical centers, hospitals, and a few independent research laboratories.

ACCOMPLISHMENTS IN COMBATING DETRIMENTAL RADIATION EFFECTS

Mr. RABAUT. Can you summarize briefly not what has been learned but what has been accomplished in combating radiation's detrimental effects?

Dr. DUNHAM. In the past 2 or 3 years we have developed what amounts to 3 approaches to the treatment of radiation injury as opposed to developing methods for shielding and protecting people against radiation. I assume your question is directed toward treatment of the injured?

Mr. RABAUT. That is right.

Dr. DUNHAM. One of the most important approaches is the development of a drug at the Oak Ridge National Laboratory, AET, which, if given a few minutes to a few hours before a person is exposed, will essentially double his resistance to radiation injury.

Now, this means that in the case of an accident or in the case of a wartime situation where a person has to knowingly be exposed, he can take this preparation and thereby would be able to survive twice as much radiation.

Mr. RABAUT. How far has the research into the effect of this been conducted?

Dr. DUNHAM. This has not been used in humans.

Mr. RABAUT. It has not been used in humans?

Dr. DUNHAM. No. We have found it works very well in mice, it works very well in rats, it works very well in monkeys. We are now, through cooperation with the National Institutes of Health and 2 or 3 other medical centers, having this drug used in patients, who are receiving radiation as treatment for cancer, in small doses to get a feel for how toxic it is to humans. It is not toxic to monkeys, it is not toxic to mice. It is somewhat toxic to dogs.

Another approach to the treatment is used after the individual is exposed. This can be used within 24 to 48 hours after an exposure. This is the transplanation of bone marrow from a normal individual. One can take mouse bone marrow and give it to an irradiated mouse, and he will survive twice as much radiation. Or can take rat bone marrow and give it to a mouse and many of them, not all, will survive twice as much radiation. The question is now whether this type of treatment can be used in humans safely.

We know that skin grafts from one human to another do not take. So we have our fingers crossed as to whether this bone marrow technique will work in humans.

In three medical centers in the Northeast they are now using this in patients who have severe damage to the bone marrow. We are awaiting the results of this with considerable anticipation.

Mr. RABAUT. All right. That is a good report.

Last year you advised us that the Atomic Bomb Casualty Commission in Japan was expanding its medical surveys to include a longevity study. Has any information of particular significance been developed as to that yet?

Dr. DUNHAM. No. It will be several years before this information is developed. They are now in the process of going over all the death certificates since 1950.

Mr. RABAUT. The answer to my question is "No?"

Dr. DUNHAM. The answer is "No."

Mr. RABAUT. You were going to tell us about a third approach which goes with the other question.

Dr. DUNHAM. There is another treatment which has to do with the material which is believed to be present in normal blood.

A substance which is present in normal blood, not in individuals who have been irradiated. This material seems to be present in the blood of pregnant cows. We have supported work at the Southwest Research Foundation for 2 years on this. We are increasing the support this next year. They hope to concentrate this substance and see

whether we cannot have another method of treating radiation injury.

This material is very fragile. It is very hard to keep and it is turning out to be quite a problem.

CONTRIBUTION OF RADIATION TO CURE OF CANCER

Mr. RABAUT. On October 12, 1956, the New York Times carried an article indicating that Dr. Rhodes of the Sloan Kettering Institute is not greatly impressed by the contribution radiation has made to our cure of cancer. Are you familiar with the article and his remarks?

Dr. DUNHAM. I am not familiar with that particular article. I am familiar with his point of view.

Mr. RABAUT. What do you think of it? I do not like to get the scientists quarreling with each other, but if it is bad, we will take it off the record.

Dr. DUNHAM. I think as Mr. Cannon said last year that to date the two best methods of treating cancer are surgery and radiation. I think what Dr. Rhodes is saying is that greater improvements in the treatment are more likely to come from the chemical approach than from radiation. We in our program of cancer research are trying to improve methods of treating cancer by radiation, but it obviously is not the answer to curing cancer any more than surgery is.

Mr. RABAUT. Do you have much of a relationship with the National Institutes of Health at Bethesda?

Dr. DUNHAM. Yes. I am a member of the Radiation Study Section of the National Institutes of Health. I am the Atomic Energy Commission's representative at the meetings of the National Cancer Advisory Council which advises the Cancer Institute's grants program.

MONITORING RADIOACTIVITY

Mr. RABAUT. Funds devoted to monitoring on a worldwide basis the radioactivity in soil, air, and water have apparently been doubling in a period of the last couple of years. To what extent are other nations participating in this program?

Dr. DUNHAM. Up until about a year ago very little of the activity was going on in other countries except in Great Britain. With the coming into being of the United Nations Scientific Committee, which has had three meetings now in the past 2 years, there is developing a considerable activity in other countries which we hope will eventually relieve us of some of the responsibility for monitoring the whole world.

SALINE WATER RESEARCH

Mr. RABAUT. Are you attempting any studies of purifying salt water from the sea?

Mr. FIELDS. You mean distillation?

Mr. RABAUT. Saline water research. I will give it the technical term.

Mr. FIELDS. I do not believe we have anything of a major nature.

Mr. DAVIS. We have been doing some study work with the Department of the Interior, with their saline water people, providing them with some information on the possibilities of utilizing reactors

that produce heat for the program. We have not been carryng on any particular research on this but merely giving them some help and advice.

Mr. RABAUT. With the falling of the water table you know there is a great need for this.

EFFECT OF HOLDING BIOLOGY AND MEDICINE PROGRAM TO 1957 LEVEL

Again in this research program you are programing a substantial increase over the current year. Please supply for the record a list of reductions to bring this program back to the 1957 level in a manner which takes into account the relative importance of the various programs. Put them in the order of priorities.

Dr. DUNHAM. May I ask you to clarify the question on the point? Do you mean the present cost level or the present program level?

Mr. RABAUT. I used the word program. Are your costs rising?

Dr. DUNHAM. Yes, sir.

Mr. RABAUT. All right, put it on a cost-level basis. Just the same as on the one we asked for before, on a cost basis in both instances.

(The information follows:)

Reductions necessary to hold to fiscal year 1957 level

[In thousands]

	Fiscal year 1957 estimate	Fiscal year 1958 estimate	Increases requested over fiscal year 1957	Reductions from fiscal year 1958 request which would be required to hold to fiscal year 1957 level
Radiation effects on biological systems	$10,552	$11,795	$1,243	0
Combating radistion detrimental effects	1,980	2,233	253	0
Beneficial applications of atomic energy	(8,978)	(9,796)	(818)	(−$3,202)
Distribution of isotopes	450	500	50	−200
Biological research	2,724	2,974	250	−1,000
Medical research	2,775	3,006	231	−1,002
Cancer research	3,012	3,299	287	−1,000
Biophysics research	17	17	0	0
Biomedical problems in atomic energy operations	6,687	8,080	1,393	−1,000
Dosimetry and instrumentation	2,329	2,761	432	−200
Equipment	1,072	1,335	263	0
Total, biology and medicine	31,598	36,000	4,402	−4,402

It should be noted that the reductions which would have to be made are not in all cases comparable to the increases requested in the various activities. This takes into account the necessity for maintaining a balance between the various activities of the program to be most responsive to the Commission's current and future requirements. Furthermore, to effectively discharge the Commission's responsibilities for the health and safety of the public and atomic energy workers in connection with AEC operations it is felt that no reduction should be made in the program of radiological health and safety. Therefore, continuing these programs at the present level and simultaneously holding to fiscal year 1957 budget could only be accomplished by a curtailment of approximately 50 percent of the research program in the beneficial and useful applications of atomic energy in the life sciences, which would necessarily result in a serious reduction of the promising program in cancer research. This is further explained in the analysis of the effect of such reductions set forth below.

Analysis of holding to the fiscal year 1957 cost or program level points up clearly that not only would urgently needed program development be eliminated, but that severe curtailment in current rate of operation would be necessitated. The above table shows those activities which would have to be reduced. There follows an explanation of the effect of such reductions in the order in which they would be sustained.

Biomedical problems in atomic energy operations, $1,000,000

One million dollars of the proposed increase in fiscal year 1958 was intended to provide funds for an intensive program in the determination of stratospheric burden of strontium 90 and other radionuclides begun late in fiscal 1957. This program would have to be abandoned.

Beneficial applications of atomic energy

Distribution of isotopes, $200,000.—There would be approximately a 50 percent reduction in the program of distributing isotopes at reduced cost for research in medicine and agriculture.

Biological research, $1,000,000.—A number of biological research activities would necessarily be curtailed or reduced. For example, it has been demonstrated at Brookhaven National Laboratory that radiation can be used to produce useful mutations in plants and seeds. For instance, strains of oats, flax, and wheat have shown resistance to costly rust diseases; stiffer straw in oats and barley; early ripening peaches, and late ripening peaches; a short type rice which yields as much as the parent strain. The program is being carried out by BNL in cooperation with 150 universities and agricultural experiment stations in the United States and abroad. This program would have to be curtailed in the event of a reduction.

Medical research, $1,002,000.—One of several important projects which would be adversely affected by a reduction is the project at the University of California Radiation Laboratory where protons, deuterons, and helium-ion beams from the 184-inch cyclotron are being used to study the therapeutic influence of the pituitary gland in human cancer and other diseases. In fiscal year 1958 it was planned to treat some 75 to 100 patients with metastatic mammary carcinoma. The possible beneficial effects of pituitary irradiation on patients with diabetes, polycythemia, and hypertension were to be explored in fiscal year 1958. The number of patients to be treated in this program would have to be reduced, possibly by as much as 50 percent.

Cancer research, $1,000,000.—This area of research would suffer a reduction of approximately one-third of the budgeted amount. Examples of such reduction are:

Medical scientists at the Argonne Cancer Research Hospital are pursuing a variety of approaches in the diagnosis and treatment of cancer and related disorders. One approach has to do with the management of those diseases which are difficult to control because insufficient red blood cells are formed. Progress is being made in the identification of the humoral substance which appears to control the production of red blood cells. This and similar projects at the Argonne Cancer Research Hospital would be curtailed.

At the Brookhaven National Laboratory the staffing and operation of the new medical center and the world's first medical reactor would have to be delayed, perhaps retarding the brain-tumor program as much as 2 years.

Dosimetry and instrumentation, $200,000

There would be a curtailment in the development of large photomultiplier tubes for aerial detection of fallout patterns, and in basic studies to understand the mechanism by which nuclear radiation interacts with matter—the effects of which permit detection and measurement of levels of radiation.

In response to the question as to the effect of holding to the fiscal year 1957 program level, the fiscal year 1957 program—exclusive of additional research needed and contemplated in the fiscal year 1958 request—could not be repeated at the fiscal year 1957 cost level. In the category of beneficial applications of atomic energy, where the brunt of any reductions would be felt, it is estimated that approximately $9.9 million would be required to carry out the fiscal year 1957 program level of $8.9 million, with no expansion, in that category, and would certainly preclude any step-up in our research program on radioactive fallout.

Mr. RABAUT. This total program was increased by $2,355,000 last year. Now you are increasing it again by $4,402,000. In view of the basic and serious problem of a shortage of scientists, how can such rapid expansion in these programs be implemented without sacrificing quality?

Dr. DUNHAM. I think during the past year there have been more scientists coming into the field. I am quite convinced that we would be able to spend this money intelligently, and get the taxpayers' dollars' worth of information out of it. I would call your attention to

the fact that about a million dollars of that $4 million increase is spent for stratospheric monitoring, which is a very expensive proposition.

Mr. RABAUT. You had an increase of $2,355,000 last year. Now it is a $4,402,000 increase. So this program is really right on the ladder, going right up.

Dr. DUNHAM. I think demands on the program are also going up. It is a matter of fitting it in with the whole program.

Mr. FIELDS. This program does feel the impact of the increased activity in the area of fallout, the effect of atomic-weapons tests, and the results of research relating to the effect of fallout on the biologic process of man. There has been a tremendous interest, which is an indication that we should accelerate our efforts in this field.

AMOUNT SPENT FOR FALLOUT STUDIES

Mr. RABAUT. How much of this is done in the fallout study?

Dr. DUNHAM. The sampling and analysis of radioactive fallout during the past year cost $1,193,000. Research on the biological hazards of fallout, that is, biological research only, related to fallout, cost $4,420,000. Now, this is exclusive of $1,500,000 in the field of genetic effects of radiation.

Mr. RABAUT. What is the total amount related to fallout.

Dr. DUNHAM. It depends on where you draw the line.

Mr. RABAUT. Where this $4 million comes in, how much is the total?

Dr. DUNHAM. The total is $5,600,000, roughly, for what one might call Project Sunshine proper, which is the monitoring of the atmosphere, the soil, the waters, and the research on the effects of the fallout materials themselves on human beings.

COORDINATION OF RESEARCH ACTIVITIES WITH OTHER AGENCIES

Mr. RABAUT. How are research programs of this type coordinated between Government agencies and between Government and private organizations to assure that there is no duplication of research effort?

Dr. DUNHAM. Probably the single most important point of coordination in the field of biology and medicine is the Bio Sciences Information Exchange, which is supported by the National Institutes of Health, the Atomic Energy Commission, the Air Force, the Veterans' Administration, the Surgeon General of the Army, the Office of Naval Research and the National Science Foundation. This institution is operated by the Smithsonian Institution for these agencies. They are advised the minute that a research grant or contract is let by an agency. They are given a 200-word summary of what that work involves.

In addition, the Cancer Society provides this organization with the same information. The funds for these agencies are the largest sources of funds available in biomedical research. When my staff receives a project from a biven investigator at a university, they will call the Bio Sciences Information Exchange and get from them information on all the support that individual is getting from any of the agencies I mentioned, including the American Cancer Society.

Mr. RABAUT. Are there any questions on this medical program?

Mr. EVINS. I have one. You have listed all these agencies, Doctor, but you did not mention the Federal Civil Defense. Are they not doing a lot of research in this area? Also, you talked about the stratospheric studies. Is that overlapped with the International Geophysical Year? We appropriated a lot of money for the atmospheric studies for the Geophysical Year.

Dr. DUNHAM. That is a separate program. Our program involves sending up balloons 50,000 to 90,000 feet and taking samples and analyzing them for physical product. The Geophysical Year is doing analysis for radioactivity in the atmosphere at different altitudes. That is quite a separate program. There is no overlap.

Mr. EVINS. Are you apprised of the amount of activity by Federal civil defense in this area?

Dr. DUNHAM. Yes. They have a fairly extensive program in civil effects. The research effort undertaken at the weapons tests, like at present at Plumbbob, is all under the direction of Mr. Corsbie, of my division, who coordinates all the projects in the civil effects tests in Nevada. We contribute some money to it. The Air Force and various other agencies also contribute to that program.

Mr. EVINS. I personally think if we could find the answer we are looking for in this field that the money would be well spent.

Dr. DUNHAM. Thank you.

CONTRACTS WITH UNIVERSITIES AND COLLEGES

Mr. JENSEN. How many universities and colleges throughout the country have contracts with the Atomic Energy Commission in the work that you head?

Dr. DUNHAM. I do not have the exact figure with me. We have 470 contracts with universities and institutions. I would say it is about 200 universities. I can get the exact figure for the record.

(The information follows:)

As of July 1, 1957, the Division of Biology and Medicine had 476 research contracts with 169 universities and nonprofit organizations.

Mr. JENSEN. They are working on your part of the program?

Dr. DUNHAM. On my part of the program.

Mr. RABAUT. Would you let me ask one question?

Mr. JENSEN. Yes.

Mr. RABAUT. Are these universities selected for their size or for their real research qualifications?

Dr. DUNHAM. They are selected on the basis of talents.

Mr. JENSEN. I am glad you asked that, Mr. Chairman.

They have to come up to a certain standard, I presume, before they receive a contract?

Dr. DUNHAM. That is right.

Mr. JENSEN. Would you care to say off or on the record what colleges or universities you feel are the most advanced in this research?

Dr. DUNHAM. In the field of radiation biology the ones which have the largest activity are the ones which were involved in the Manhattan District program: the University of Chicago; the University of California; the University of Rochester; and Western Reserve University. There are many other universities which have developed programs in

this area with very, very fine talent in them, for example, Stanford University, the University of Michigan, and the University of Minnesota. They were not involved directly with the Manhattan District. They came in a little later. I think one should not confuse the number of individuals working or the size of the effort necessarily with the quality, because there may be in some school one person who is quite outstanding, who operates pretty much by himself without a huge program going in several departments in this area.

Mr. JENSEN. Their contracts are with different dollar values, I presume.

Dr. DUNHAM. That is correct.

Mr. JENSEN. Depending on the ability as you see it, of the college or university?

Dr. DUNHAM. It is more the ability of the individual, like Dr. Titus Evans at Iowa State. He has a very fine program. It is not a large program, but it is first quality.

Mr. JENSEN. I have heard that Dr. Evans was carrying on very valuable research for you people. Of course we are very proud of the college.

SALINE WATER PROGRAM

I have been greatly interested in the saline-water program and since it requires heat in most of the methods of desalting and demineralizing water one would naturally come to a conclusion that because of the terrific heat generated by atomic energy there might be a great possibility in using atomic energy to desalt and demineralize water. I take it that you have not gone too deeply into that program. Demineralizing and desalting of water must come sooner or later. There is no question about it. Because of the fact that we know that water is worth as much as gold in many areas of the country. We did not realize how valuable water was in the State of Iowa until we had a number of droughts; now the people of Iowa realize what water really means to the economy of the country. They are developing a system to desalt and demineralize water from the sun's rays.

Now, knowing that it takes heat to demineralize salt water, I could imagine that there might be very great possibilities in the use of atomic energy. I would be very happy if the Atomic Energy Commission would put one of its experts on that job to carry it through in cooperation with the Saline Water Branch of the Interior Department. I happen to be a member of that committee also, and they are experimenting with many different kinds of methods of desalting and demineralizing water, as I am sure you know. But I do not think that they have any experiment yet using atomic energy. It may be too expensive, but water is a great necessity for life, not only vegetable, but also humans, and it is a very important thing for us to look into. I do believe it would be helpful for the Atomic Energy Commission and you gentlemen to make a pretty thorough study of it.

Mr. FIELDS. As Dr. Davis indicated, we have been happy to work with the Interior Department on this. Our activity has been the development of reactors which will really be the heat source. We have not had any feeling that we had responsibility or authority to work in this other area. We will be very happy to work with the Interior Department. I believe this is the basis on which we have proceeded, is it not?

Mr. DAVIS. Yes. We have been working with the people in the Department of the Interior that have been working on this, and providing them with some estimates of what heat from nuclear sources might cost. But you have two problems there. One of them is to develop a method of utilizing heat regardless of its cost that would produce water cheaply enough, even though the heat might be very inexpensive. The second problem with respect to the use of atomic energy would be to get the heat from atomic energy to a point where it would be competitive with heat from other sources. We have been trying to provide them with some estimates and some estimates particularly on heat at low temperatures. That is one of the differences they have. You can carry on the salt water conversion process with low temperatures but it takes a lot of heat to do this on a large scale.

Mr. JENSEN. I am sure of that. And because of that fact, the experiments that are now taking place in the desalting and demineralizing of water, the great problem is to get enough heat into a great body of water or flowing stream to burn out the water and burn out the minerals in that water that are injurious to life and vegetables. But I shall not burden the committee with any more of that, nor you gentlemen, except I do know, as the chairman said, our water table is going down and we could one of these days find that we had a terrific water shortage. You know, we are using about 10 times more water per person than we did 50 years ago. The trouble is that we do not reuse it. It goes into the sewer and the sewer goes into the streams and the streams flow into the ocean and we lose it.

I have concerned myself considerably with that problem for quite some time. Not being a scientist or engineer in any sense of the word, I grope for knowledge and try to be as helpful as I can in that field.

I think that is all, Mr. Chairman.

OPERATION OF MANHATTAN ENGINEERING DISTRICT

Mr. FENTON. Doctor, how did the Manhattan District operate——

Dr. DUNHAM. General Fields should answer that, because he was part of the Manhattan District.

Mr. FIELDS. I was assigned to the Manhattan District at one time. Their activities, to the extent that we have carried them on, have been taken over by the Atomic Energy Commission and have continued to be operated. They operated all over the United States in different places.

Mr. FENTON. What principal cities?

Dr. DUNHAM. They had offices in New York, Chicago, and the Berkeley-San Francisco area in California. Those were their three principal original offices. Then they developed the Oak Ridge plant, the Clinton works, which of course was not near a medical center, and then the Hanford works which again was not near a medical center, and then Los Alamos. Those were the principal areas of activity.

Mr. FENTON. You had some around New York.

Dr. DUNHAM. We had programs in New York. The medical program began really at the University of Rochester. Dr. Stafford Warren, who was professor of radiology at the university medical school, became the principal medical officer for the Manhattan District. He got his people going in this field quite early.

Similarly, the University of Chicago, where the first controlled reaction pile was built, got into this very early, and the University of California at Berkeley.

UNIVERSITY CONTRACTS IN EASTERN UNITED STATES

Mr. FENTON. I noticed in your enumeration of contracts that there were not any schools east of Rochester involved.

Dr. DUNHAM. Pardon me?

Mr. FENTON. No contracts with the eastern medical schools or universities.

Dr. DUNHAM. I do not quite understand. You mean at present or at the time of the wartime projects?

Mr. FENTON. The contracts that you enumerated a few moments ago in response to Mr. Jensen.

Dr. DUNHAM. I just recited examples. Now, we have contracts at Harvard and we have them at Massachusetts Institute of Technology. We have them at three schools in New York City. We have them at Syracuse University. We have them in Albany. We have them of course at the University of Pittsburgh and the University of Pennsylvania. We have them in practically every State in the country. There are only 1 or 2 States in which we do not have contracts.

STAFFING OF LABORATORIES

Mr. FENTON. Now, in your own laboratories, Doctor, how do you staff your own institutions?

Dr. DUNHAM. With the exception of the Oak Ridge National Laboratory, all of the biomedical laboratories are operated by university contractors or groups of universities. The Brookhaven program is operated by Associated Universities, Inc. The Argonne National Laboratory is operated by the University of Chicago. The Argonne Cancer Research Hospital is operated by the University of Chicago. The work at Donner Laboratory and the Crocker Laboratory in Berkeley is operated by the University of California. These institutions and laboratories, are staffed, through what you might call the normal staffing procedure. They began by selecting a competent director. He went around and developed a research staff. Since then the programs are being staffed by young scientists coming out of medical school, out of graduate school, to work as junior scientists in the laboratories, and as they develop they become more senior and carry on more mature programs.

Mr. FENTON. Where is this new medical center that you are contemplating?

Dr. DUNHAM. I believe you are referring to the new medical building and reactor at the Brookhaven National Laboratory. The staff is already there. It has been operating in the old Camp Upton hospital, in wooden buildings that were left over from the war. This is a matter of building a permanent structure within which to carry out their program, there is in addition, a research reactor which would be devoted exclusively to medical research.

CURE FOR CANCER

Mr. FENTON. Now, the chairman mentioned a while ago a newspaper article comparing what Dr. Rhodes thought about the work being done. I do not know where those newspapers get their ideas. A currently weekly newsletter that is sent out has listed cancer being eradicated in the next few years. Do you know anything about that?

Dr. DUNHAM. I think that is a very optimistic statement unless somebody will define the next few years as probably quite a few years.

Mr. FENTON. I think within the next 15 or 20 years.

Dr. DUNHAM. That is more like it. We hope we are contributing to that particularly through the basic work with radioisotopes.

Mr. FENTON. That was in the Kiplinger letter, I believe.

Dr. DUNHAM. Yes.

Mr. FENTON. I am glad to note that you have been successful in developing a system of giving us some new information on the blood stream. I hope that approach is correct. What is the name for that AET?

Dr. DUNHAM. AET is S, 2, aminoethylisothiouronium.

Mr. FENTON. That is all, Mr. Chairman.

Mr. RABAUT. To clear up this request that we made before, we asked for this table for 1957. We want one from Dr. Dunham. We want them both on two levels, cost basis and program.

Mr. FIELDS. Continuation of the program basis?

Mr. RABAUT. And cost basis, both ways. It will assist us in our deliberations.

Mr. FIELDS. All right, sir, we understand.

Mr. RABAUT. The committee will be adjourned until 10 o'clock tomorrow morning.

FRIDAY, JULY 12, 1957—10 a. m.

Mr. CANNON. The committee will be in order.

Continuing where we left off yesterday, the gentleman from New York, Mr. Taber.

ADDITIONAL WING FOR GERMANTOWN BUILDING

Mr. TABER. I wonder if you could tell us a little bit more about that new office building and your desire to add a wing to it. I would like to get at the meat of that question.

How big is that office building now?

General FIELDS. Yes, sir; we can do that.

You mean the building that is presently under contract?

Mr. TABER. Yes; the one that is out near Rockville.

General FIELDS. It is a short distance beyond Gaithersburg, located right near the new superhighway that is going through there.

Mr. DERRY. Mr. Taber, the office space in the building is 181,200 square feet. That is the office space which is under contract now.

Mr. TABER. Give us a little description of that building.

Mr. DERRY. It is a wing-type building consisting of five stories. The ground floor is mostly below grade. There are four stories above grade.

It consists of six wings. It is reinforced concrete, faced with brick. The reinforced concrete is designed to withstand a blast pressure of 4 pounds per square inch.

The building is designed to withstand an explosion over Washington. It is a conventional office-type building, generally designed in a conventional way so that we can use conventional offices and can put in movable partitions to change the size of offices and move around as we see fit.

Mr. TABER. When was it designed?

Mr. DERRY. Design was started in July of 1955. The building was authorized by the Congress and approved by the President on May 6, 1955.

Mr. TABER. How many employees did AEC have at that time whom it was contemplated would be housed in that building?

Mr. DERRY. I would like to qualify the answer, Mr. Taber, by saying that we house in the building other people in addition to AEC employees. We have assigned military personnel, that is, officers and civilians, as well as General Accounting Office personnel.

Mr. TABER. They are your usual AEC complement?

Mr. DERRY. Yes, sir.

Mr. TABER. You had them assigned to you at that time?

Mr. DERRY. Yes, sir.

Mr. TABER. And you still have?

Mr. DERRY. Yes, sir.

Mr. TABER. You see nothing in the picture at the moment that would justify any substantial reduction?

Mr. DERRY. No.

Mr. TABER. So that is something that should be figured up?

Mr. DERRY. Yes, sir. The number of people computed on that basis was approximately 1,400 at that time and design was started on the basis of housing 1,400 people.

Mr. TABER. That means something like 130 square feet to a person?

Mr. DERRY. Approximately 130 square feet, sir.

Mr. TABER. How many do you have now?

Mr. DERRY. The number of people that need to be housed now on that same basis is estimated at aproximately 1,758.

Mr. TABER. This new wing will provide how much new floorspace?

Mr. DERRY. It will produce 56,000 square feet of office space. It is roughly 125 to 130 square feet to a person, again.

Mr. TABER. It will be a little more than that. It will be 160.

Mr. DERRY. That 56,000 is designed for 380 people which is more than the difference between the original estimate of 1,400 and the current estimate of 1,758. This is because some of the people under each estimate would not go into office space.

The overall average of square feet per person for office space is roughly 130 square feet for both the basic building and the design for the addition.

Mr. TABER. How much will this building cost?

Mr. DERRY. Our estimate of the total cost of the building is $13,300,000.

Mr. TABER. What will the wing cost?

Mr. DERRY. The wing is $3,300,000. The total building will be $13,300,000.

Mr. TABER. The total building, including the wing, will be $13,300,000?

Mr. DERRY. Yes, sir.

Mr. TABER. In other words, this building is costing $10 million the way it stands.

Mr. DERRY. Yes, sir; that was the previous authorization.

Mr. TABER. Do you expect that that building will be required right along?

General FIELDS. Mr. Taber, we do, so long as we have a headquarters in the Washington area. It is the headquarters building for the Atomic Energy Commission.

Mr. TABER. Will you have in addition any space within the District?

General FIELDS. We do not contemplate any space other than that required by law. We have to keep offices for legal processing in the District of Columbia itself.

We would hope we could rent a little space for a few offices for that purpose. When we get into the regulatory aspect there could perhaps be a requirement for space for hearings to be conducted right in the District.

But at the present time we contemplate that our only principal office as a headquarters office would be this building.

We will still have to house several hundred people in Washington until the additional wing is completed.

In other words, we will need to retain some of the space we have until such time as the move is completed.

Mr. TABER. How near completion is this building?

General FIELDS. We believe the building now under construction should be completed near the end of this year. Our target has been to move sometime in the month of November.

However, it could be that it would be a month later, or something like that.

Mr. TABER. The joint committee has reported out and Congress has passed the authorization bill now?

General FIELDS. The joint committee reported the authorization bill and it has passed both Houses of Congress, sir.

Mr. TABER. Has it been signed?

General FIELDS. It has not yet been signed, sir. I believe it was just passed on Wednesday by the House. It had been passed by the Senate previously.

Mr. TABER. In what item in the justifications is the fund for this building?

General FIELDS. Mr. Taber, the reason we brought it to the committee at this time is that we do have funds that are unobligated in the "Plant acquisition and construction" appropriation which is not yet before the committee. These balances are savings from previous year funds and could be applied to this wing.

Mr. TABER. You still have funds in that other appropriation that we have not considered yet?

General FIELDS. That is correct; yes, sir.

Mr. TABER. I guess that is all I have on that.

General FIELDS. Our reason for bringing it before you now is because we do have those funds. If the committee had no objection, we could proceed now so that it could be handled as expeditiously as possible in conjunction with the construction that is now going on.

Mr. RABAUT. My understanding is that you would submit it for new bids, though.

General FIELDS. Yes, sir.

Mr. RABAUT. But you feel that because of the fact that the present contractor has so much material and equipment on the grounds, you might get an extraordinarily favorable bid from him?

General FIELDS. I would hope that we would; yes, sir.

But since it is in the construction stage, it would be better to get moving with it whether it is the same contractor or not.

Mr. RABAUT. But you are going to submit it for bids?

General FIELDS. Yes, sir.

Mr. CANNON. It seems to me that if you are going to build this extra wing, the sooner you know about it the better.

I would like to ask Mr. Rabaut, who has heard all of the testimony, what is recommendation is.

Mr. RABAUT. We agreed generally yesterday that we probably should let them go ahead.

Mr. CANNON. What do you think about it, Mr. Taber?

Mr. TABER. I am inclined to think that probably we have to let them go ahead with it.

Mr. CANNON. Without objection, the committee will authorize you to go ahead.

If you are going to do it, the sooner you know about it, the better.

General FIELDS. Thank you, Mr. Chairman.

Mr. CANNON. Of course, it is our understanding that every requirement will be complied with and that you will advertise for bids.

General FIELDS. Yes, sir; we will go out with invitations for bids immediately, within the next week, I hope, Mr. Chairman.

Mr. CANNON. Out of your unobligated balances?

General FIELDS. Yes, sir.

THURSDAY, AUGUST 8, 1957

TRAINING, EDUCATION, AND INFORMATION

Mr. CANNON. The committee will be in order. I will insert in the record pages 155 through 162 of the justification.

(The information follows:)

TRAINING, EDUCATION, AND INFORMATION PROGRAM, OPERATING COSTS

Program statement

Estimate fiscal year 1958	$17,500,000
Estimate fiscal year 1957	8,827,000
Increase	8,673,000

This program is directed toward broadening the base of nuclear knowledge and technology both at home and abroad. While for the most part the activities encompassed by this program are not new to the Commission, fiscal year 1958 represents the first year in which these activities are being consolidated to form the new program, training, education, and information. The activities accumulated herein have, in the past, been included as parts of the reactor development, physical research, biology and medicine, and program direction and administration programs.

The estimates for the training, education, and information program include the costs incurred in operation of the Commission's International School of Nuclear Science and Engineering at Argonne, Oak Ridge School of Reactor Technology, Oak Ridge Institute of Nuclear Studies, and for the first time the Puerto Rican Training Center. Also included are the costs for carrying out various fellowships programs; assistance to high schools, colleges, and universities in the way of faculty training, equipment, and training aid grants, including loans of special nuclear and source material for which the Commission bears the fabrication and processing costs; assistance to foreign countries by providing consulting services in connection with formulation of their atomic energy programs; participation in special conferences on atomic energy; and finally, the operation of museums and exhibits as well as providing publications and library services together with related technical information activities.

The major objectives of the program in fiscal year 1958 are to achieve:

1. A major step forward toward the goal of providing universities with the capability to be able to train nuclear engineers at the rate of 2,000 per year by 1962;

2. An expanding implementation of the President's atoms-for-peace program by increasing the number of foreign personnel attending our reactor schools; operating facilities for training our Latin American neighbors in the nuclear and reactor sciences; and through consultations, conferences, and specific studies, assist foreign nations to progress in developing sound atomic energy programs; and

3. A growing interest and knowledge of matters relating to atomic energy, domestically, by dissemination of information through technical publications and exhibits.

The increase of almost 100 percent is due to the fact that the programs for support to universities in the training of nuclear scientists and for assistance to foreign nations are of recent origin and were just getting underway in fiscal year 1957.

Summary of estimates by category

	Actual, fiscal year 1956	Estimate, fiscal year 1957	Estimate, fiscal year 1958
1. Operation of schools	$1,324,032	$1,416,000	$1,740,000
2. Fellowships	216,043	850,000	1,015,000
3. Assistance to schools	161,770	4,207,000	8,705,000
4. International conferences and studies	722,407	220,000	2,850,000
5. Technical information	2,227,149	2,134,000	3,190,000
Total, training, education, and information program costs	4,651,401	8,827,000	17,500,000

JUSTIFICATION OF CATEGORIES

1. Operation of schools, $1,740,000

The AEC schools operated at the Oak Ridge and Argonne National Laboratories and the specialized training courses conducted at the Oak Ridge Institute of Nuclear Studies will be continued in order to make the unique facilities of these sites available for training and education. In addition, in fiscal year 1958, it is planned to establish a nuclear training center at the University of Puerto Rico to be available to students from Latin-American countries. The estimates of attendance and cost of operation of these facilities are set forth below:

	1957	1958
International School of Nuclear Science and Engineering, Argonne, Argonne National Laboratory:		
Annual student output (2 courses with 60 students each)	120	120
Operating costs	$590,000	$590,000
Pennsylvania State University:		
Annual student output (2 courses with 30 students each)	60	60
Operating costs	$60,000	$60,000
North Carolina State College:		
Annual student output (2 courses with 30 students each)	60	60
Operating costs	$60,000	$60,000
Total International School of Nuclear Science and Engineering, Argonne:		
Annual student output	120	120
Operating costs	$710,000	$710,000
Oak Ridge School of Reactor Technology:		
Annual student output (2 courses with 120 students each in fiscal year 1958)	120	240
Operating costs	$360,000	$360,000
Oak Ridge Institute of Nuclear Studies	$346,000	$370,000
Puerto Rican Training Center	0	$300,000
Total, operation of schools	$1,416,000	$1,740,000

The International School of Nuclear Science and Engineering is conducted by Argonne National Laboratory. Students study at either Pennsylvania State University or North Carolina State College the first semester and at Argonne the second semester, thereby permitting the school to double the number of its graduates each year from 60 to 120.

The increase in the number of students without an increase in costs for the Oak Ridge School of Reactor Technology is possible as a result of successful negotiation of contracts with a number of universities whereby these universities will offer the first half of the ORSORT program with AEC guaranteeing adequate numbers of tuition paying students, and ORSORT will conduct the second half of the course.

2. Fellowships, $1,015,000

To assure that superior students will remain in schools for advance work in reactor technology, the AEC is providing assistance in the form of special nuclear engineering fellowships. The program initiated in fiscal year 1957 is expected to provide courses of study for approximately 150 students. The program for fiscal year 1958 provides for continuation at approximately the same level at a cost of $475,000.

The demand for personnel trained in the problems of radiation and toxicology peculiar to nuclear energy operations continues to grow in the fields of industrial hygiene, industrial medicine, and particularly in health physics. Increased efforts will be applied in fellowship training programs in these areas.

A new program for advance training in radiological physics is to provide the Commission with a small group of thoroughly trained scientists qualified to assume senior responsibility for health-physics programs in Commission laboratories. Under this program, graduate training leading to the PhD degree will be offered to 10 candidates per year, selected from the best qualified contractor personnel currently working in the health physics programs.

Amounts required for the various fellowship programs are summarized as follows:

	Fiscal year 1957		Fiscal year 1958	
	Number	Amount	Number	Amount
Nuclear engineering	150	$470,000	150	$475,000
Radiological physics	72	263,000	100	373,000
Industrial hygiene	8	42,000	8	42,000
Industrial medicine	11	75,000	11	75,000
Advance training in radiological physics	0	0	10	50,000
Total, fellowships	241	850,000	279	1,015,000

3. Assistance to schools, $8,705,000

In fiscal year 1958, the budget estimate is increased by $4,498,000 over fiscal year 1957 to provide funds for expanded educational assistance programs to schools. Of this increase, $3 million occurs in the program for making grants to universities to help them acquire reactor training equipment, teaching aids, demonstration apparatus, and laboratory equipment. Under the existing program, requests for assistance in this area totaling over $6 million had been received prior to January 1, 1957.

A new program to be started in fiscal year 1958 is that of providing specialized isotopic equipment and limited operational assistance to medical schools, hospitals, selected schools of public health, universities, and colleges. This program is designed to encourage the use of radioisotopes as research tools for medicine, biology, and agriculture and to provide training in radiation safety.

In cooperation with the National Science Foundation, university summer courses in general science, emphasizing the utilization of radioisotopes, will be made available to high-school science teachers. It is anticipated that the stimulation of interest in the effective utilization of atomic energy at the high-school science level will eventually assist in overcoming the shortage of talented scientists in these important fields. Also, if the AEC's program of assistance to universities in acquiring teaching equipment is to be successful, the schools must be given opportunities to develop faculty competence in the nuclear-technology field. Therefore, the AEC, in cooperation with the National Science Foundation, has started a program for special faculty training in nuclear technology for university faculty members.

Present policies of the Commission authorize the loan of special materials, source materials, and other materials peculiar to nuclear technology to educational institutions, and that the Commission will, without charge, fabricate neutron sources and fuel elements, reprocess fuel elements, and perform a number of additional services for universities. As universities begin to acquire equipment to utilize these materials, the costs of fabrication and processing are expected to increase.

The following is a comparison of the details of the estimates for the fiscal years 1957 and 1958.

	Fiscal year 1957	Fiscal year 1958
A. Training, equipment, and assistance:		
(1) Reactor training equipment	$3,000,000	$6,000,000
(2) Isotope training assistance, medicine	0	440,000
(3) Isotope training assistance, biology and agriculture	0	300,000
(4) Radiation safety training assistance	0	150,000
Total training, equipment, and assistance	3,000,000	6,890,000
B. Faculty training:		
(1) Radiobiology training for high-school science teachers	63,000	500,000
(2) Radiobiology lecture series	0	5,000
(3) Special faculty training in reactor technology	350,000	400,000
Total faculty training	413,000	905,000
C. Nuclear materials services	478,000	590,000
D. Development of pedagogical tools	215,000	215,000
E. AEC laboratory training courses	101,000	105,000
Total assistance to schools	4,207,000	8,705,000

4. International conferences and studies, $2,850,000

The estimate for fiscal year 1958 includes $2,500,000 for participation in an international conference on atomic energy on about the same basis as the Commission's role in the 1955 Geneva Conference, including provision for a special exhibit, and for support of international conferences convened to examine special areas of science relating to atomic energy.

The remainder of the estimate provides for studies by the AEC on the atomic energy capabilities of cooperating countries in order to provide a base for development of programs of assistance to such nations. It is anticipated that small groups of scientists and engineers, under consultant contracts with AEC, will travel to several nations to examine the working level capabilities with respect to atomic energy activities and prepare recommendations as to specific types of

assistance which would be in balance with these capabilities in the way of implementing the President's atoms-for-peace program.

5. Technical information, $3,190,000

The major portion of this estimate, $2,535,000, represents costs incurred in connection with publications and establishment and maintenance of libraries to broaden the dissemination of information on matters relating to atomic energy.

Involved are functions such as the operation of the Technical Information Service at Oak Ridge, and information services in the form of translation programs, contract preparation of texts and technical progress reviews, establishment of classified depository libraries, and printing costs for material distributed under the industrial participation activities of the Commission. The balance of the estimate, $655,000 is for operation of the American Museum of Atomic Energy at Oak Ridge and for costs of traveling atomic-energy exhibits.

The increase of $1,056,000 over fiscal year 1957 occurs in the following areas: (*a*) publications and libraries, $565,000; (*b*) museums and exhibits, $99,000; and (*c*) operation of the Technical Information Service at Oak Ridge, $392,000. These increased estimates result from the Commission's responsibility arising from the Atomic Energy Act of 1954 to make information available to industry and to the general public on a current basis and in a usable form.

The increase for publications and libraries results from (1) initiation of a series of technical progress reviews for industry, a rapid bulletin service on AEC policy determination and technical developments for the technical press and managements of science and industry, and classified depository libraries where access permitholders may review the available classified literature; (2) expansion of the contract program for writing books and serving industry with compilations of technical data essential for peaceful uses of atomic energy and (3) expansion of the translations program to make technical data from U. S. S. R. and other journals and monographs quickly available.

The increase for museums and exhibits represents establishment of a program for showing exhibits of AEC publications at industrial and scientific fairs and meetings, and expansion of the atomic energy traveling exhibits program.

The increases for the Technical Information Service at Oak Ridge are required for providing information materials to industry and the general public on a greater scale through reproduction of engineering drawings and microcard copies of reports for sale to industry; supplying document collections to educational institutions offering curricula in nuclear energy; and establishing additional foreign depository libraries under the atoms-for-peace program.

PUERTO RICAN TRAINING CENTER

Mr. CANNON. Now, General Fields, why should we undertake a new school in Puerto Rico for Latin Americans? I might say we are continuing where we left off.

Mr. FIELDS. Mr. Chairman, I believe Commissioner Libby would wish to speak to that question if it is all right with you.

Mr. CANNON. Dr. Libby, we would be glad to hear you.

Dr. LIBBY. Mr. Cannon, we have a problem of education which is worldwide. We must educate not only the young students but the grown people about the atom. So, in order to implement the President's atoms-for-peace program—that is, the use of the atom in foreign affairs—we must conduct educational activities for our foreign friends until they can get on their feet and can do it themselves.

The Puerto Rican school is for the purpose of doing this in the Spanish language for our Latin American friends. We have as you know, Mr. Cannon, already established and had running for some time now a school in this country at the Argonne Laboratory for the education of students who are sent to us from abroad. But the Puerto Rican center is to be conducted in the Spanish language for the Latin American countries. I think it is a good thing to do. We have good men lined up to run it and we think it is a good thing

to try. We do know there is a major problem in education which we must solve. We are trying very hard to do this. I am behind this. I think this is a good effort. We will know better after we have tried it for a while, of course.

Mr. CANNON. Then you think there is no doubt that this institution would be a real contribution to American scientific thought?

Dr. LIBBY. That is right. I do not believe there is any doubt about it. I don't think the Atomic Energy Commission has ever spent money on anything that has paid off as well as the money it has spent on education. I would expect the Puerto Rican money to do similarly well. I may be wrong, but I don't expect so. We have gone into the matter of who is going to handle it and we have a man who is lined up to take care of it for us. I think we can say that it will work.

COSTS OF PUERTO RICAN TRAINING CENTER

Mr. CANNON. General Fields, what would be the cost of such a school? Can you give us a breakdown of the cost of this installation and maintenance?

Mr. FIELDS. Yes, sir. We have in the authorization bill which is still under consideration, as you know, by the Congress, a request for $2.5 million for the construction of facilities, including a swimming pool reactor, at the University of Puerto Rico. In the operating appropriation now before you, on page 157, there is a request of $300,000 for the operating cost during fiscal year 1958. When this project reaches a steady state, the operating cost would approximate a million dollars a year.

Mr. CANNON. The cost would be progressive.

Mr. FIELDS. It would rise to about a million dollars a year, Mr. Chairman. That is our present estimate.

Mr. CANNON. Will you give us some detail about the expenditure of this $2.5 million?

Mr. FIELDS. That is in the plant appropriation that we will be discussing later. Do you wish it now?

Mr. CANNON. That would not be a part of the operation?

Mr. FIELDS. No, sir, that would not be part of the operation of the center.

INTERNATIONAL CONFERENCES AND STUDIES

Mr. CANNON. Since the United States has ratified the treaty and become a member of the International Atomic Energy Agency, it will result in the United States spending a minimum of $2 million as a share of the cost. In case that should be done, would that have an effect on your need for the $2.8 million for international conferences and studies?

Mr. FIELDS. No, sir, I don't believe it would.

Mr. CANNON. It will not supply a part of that requirement?

SECOND INTERNATIONAL CONFERENCE ON ATOMIC ENERGY

Mr. FIELDS. The money in this request is for participation in a second international conference, similar to the Geneva Conference in 1955. That was a very extensive international scientific conference

sponsored by the United Nations and in which all nations participated. It is my understanding that this Government was sympathetic to a second conference after 3 years. All the nations considered that there should be a second international scientific conference. Such a conference is scheduled for September of next year. This request would take care of the participation in that scientific conference. This conference is related to the International Atomic Energy Agency, but it is a specific international conference in itself.

Mr. CANNON. How is this $2.5 million established? Is it part of an arranged quota?

Mr. FIELDS. It is based largely on the number of participants that we estimate we would have on the delegation, and includes such items as the travel costs of these participants. Approximately a million dollars is included for exhibits that we would propose to set up.

Our experience in the Geneva Conference of 1955 was that our expenditures were in the neighborhood of $2,392,000.

Mr. CANNON. Then this $2.5 million is fixed largely by ourselves?

Mr. FIELDS. Yes, sir.

Mr. CANNON. It is not a quota imposed upon us by the agency?

Mr. FIELDS. No, sir. The estimate results from the planning of our participation in that Conference which is completely within our own control.

BENEFITS OF INTERNATIONAL CONFERENCES

Mr. CANNON. In spending this amount, what would you evaluate the benefits to be? In other words, from the investment of the original $2 million and the additional amount?

Dr. LIBBY. If I may answer the question, we have established ourselves as the world leader in the uses of the atom, both military and peaceful, and it is our purpose and intention to maintain this position. As I said a moment ago, at the present time our principal task in developing the atom and applying it is one of education. This exceeds in importance the tasks of developing atomic power and even of developing the bombs in my opinion. The problem of educating the average person about the atom is in many ways our main and most important task.

Now this Conference is a good way of educating people about the atom. The Geneva Conference in 1955 was worth every nickel we spent on it on these grounds alone. In addition, from these conferences we learn something, too, but I speak now purely of their use in educating people about the atom and in maintaining our position of leadership. I think that is worth all of this money.

In addition to the educational aspects, we get information and learn a great deal from the other countries. Also, the Conference itself encourages our people to write and to publish their work, and thus we learn more from ourselves by virtue of having these conferences. It is a strange thing, but this is a big country and a man in Oak Ridge may know something that a man elsewhere in industry does not know, and these conferences catalyze communication.

The whole effort, it seems to me, paid off very well in 1955, and I think it will pay off very well in 1958. We are proposing to spend

about the same amount of money. We do not have any other yardstick to go by.

ASSISTANCE TO SCHOOLS

Mr. CANNON. In the operation of schools, and in the grants to schools, you do not make it very plain in the justification just what benefits would accrue. Just how do you evaluate the advantage to be derived from these grants that are to be given to the individual schools?

Dr. LIBBY. The grants to schools are to help the schools to teach courses in atomic power engineering.

Mr. CANNON. Which otherwise would not be given?

Dr. LIBBY. That is right, sir. For example, many of the leading engineering schools in this country do not have the equipment to teach these courses. That is why we had to found the Argonne School to teach these courses. Prominent schools like MIT, Cal Tech, the best engineering schools in the country, could not take on the task of educating students in graduate atomic power engineering because they did not have the equipment. We have undertaken to help them get this equipment. That is what this money is for. We have developed considerable enthusiasm now and many of the schools are interested in coming into the program to establish courses in atomic power engineering.

You understand, Mr. Cannon, this is for a graduate engineer who takes a year or so to become expert in this special field. What we do is to help them buy or build little reactors which they can disassemble and put together and study. These are not big operating reactors, in most instances. They are training reactors. There are some cases where schools want real live operating reactors but most of them want these little reactors which they can tear apart and which can be used to explain the principles of atomic reactors.

Mr. CANNON. You are increasing the amount for assistance to schools from $4,207,000 in 1957 to $8,705,000 in 1958. Is all of this money disbursed in grants to schools or is a portion of this money used for some other purposes?

Dr. LIBBY. I believe it is all used for grants to schools. May I ask Mr. Kaufmann, who is in charge of this, to speak?

Dr. KAUFMANN. $6 million is in grants directly.

Mr. CANNON. Just how much is used in grants to schools, and how much is used for some other purpose out of this proposed $8,705,000?

Mr. FIELDS. Mr. Chairman, if you will look on page 160, you will see $6,890,000 is proposed for grants for training equipment and assistance. The remainder of this item of $8,705,000 has to do with faculty training. You will recall at our hearing with you last year there was a great deal of discussion about stimulating the interest in this field of education in the high schools. The estimate provides for radiological training and radiobiology training for high school science teachers which has been very helpful in the last year or so. We believe that program should be stepped up. But for your specific question as to the grants, item A on page 160 in the amount of $6,890,000 is proposed. The first subitem for $6 million is for grants in equipment for training.

REACTOR TRAINING EQUIPMENT

Mr. CANNON. That first $6 million is spent for reactor training equipment.

Mr. FIELDS. Yes, sir.

Mr. CANNON. There is nothing there in the way of actual expenses for students or anything of that nature?

Mr. FIELDS. No, sir. The basic purpose of this program is to achieve an output of engineers trained in reactor work at the rate of 2,000 per year by 1960. In order to do this we considered appropriate ways. Last year, fiscal year 1957, we requested $3 million for this purpose. This year, fiscal year 1958, we feel that we will need $6 million. We equipped about 30 schools with training equipment last year. About 60 additional engineering schools would be included this year, so that you would reach an appropriate level of training in engineering schools.

Mr. CANNON. In the expenditure of this $6 million, what contribution does the school make? Does it supply part of it?

Mr. FIELDS. The school submits a proposal which lays out a curriculum, the staff they have, and the competence of the faculty. They must tell us exactly what the curriculum and program would be before they are accepted. An announcement was made that all schools could submit proposals.

Mr. CANNON. Generally speaking, what would you say would be the total cash value of the contribution of the schools?

Mr. FIELDS. Do you have a figure for that, Mr. Kaufmann?

Mr. CANNON. Of course, that would be purely an estimate.

Mr. FIELDS. What has been our experience normally?

Mr. KAUFMANN. The schools have been contributing from 4 to 5 times the amount of the contribution the Commission has made.

Mr. CANNON. In other words, for this expenditure of $6 million, you expect to get something like $30 million contribution from the schools.

Mr. KAUFMANN. That is right.

Mr. FIELDS. This amount is for very specialized equipment, Mr. Chairman. It cannot be used for buildings or anything of that nature. It is used, for example, for graphite to build a mockup of a reactor.

Mr. CANNON. It is not material that can be used in any other course except this particular course?

Mr. FIELDS. Normally it would not be, although there may be some kind of electronic gear that I presume could be used elsewhere occasionally.

Mr. CANNON. On this $6 million, will you supply the committee with a breakdown showing just what schools and how much is to be granted to each school?

Mr. FIELDS. Yes, sir. We have a limit of $350,000 per school.

Mr. CANNON. What is the minimum?

Mr. FIELDS. The minimum could be anything below that which would be for a specific program. Normally I imagine it is $10,000.

Mr. KAUFMANN. We have some that amounted to $500.

Mr. CANNON. How many schools received the maximum?

Mr. FIELDS. No one as yet, sir. They can come back for additions after their initial proposal. I believe there have been several of them that are of the order of $200,000.

Mr. KAUFMANN. That is right.

Mr. FIELDS. We will supply a list of the awards that have been made, and the current proposals that are in, sir.

(The information follows:)

Proposals received for financial grants to educational institutions

Institute	Amount of grant requested	Amount of grant awarded [1]
University of Pittsburgh	$376,442.00	$60,500
University of Washington	141,547.00	109,500
North Carolina State College	301,500.00	202,800
University of Minnesota	128,305.00	94,600
University of Wisconsin	[2]	
Youngstown University	14,450.00	
Massachusetts Institute of Technology	69,275.00	69,250
State College of Washington	109,770.00	105,000
University of Maryland	19,976.50	19,950
Ohio State University	53,996.00	48,850
Florida State University	35,129.50	
University of Utah	88,668.00	88,650
Oklahoma Agricultural and Mechanical College	172,955.30	144,850
Rensselaer Polytechnic Institute	350,000.00	168,300
University of Notre Dame	13,468.00	13,400
Miami University	5,831.00	5,800
University of Michigan	342,478.00	107,450
West Virginia University	34,660.00	34,650
Virginia Polytechnic Institute	235,716.57	159,700
University of California (Los Angeles)	118,500.00	
University of California (Berkeley)	142,035.00	142,000
University of Puerto Rico	216,952.00	216,950
Oregon State College	148,624.00	
University of Florida	321,528.50	225,550
Arizona State College	279,588.00	
Pennsylvania State University	260,270.00	205,100
The Catholic University of America	229,000.00	123,350
University of Wyoming	111,960.00	
Georgia Institute of Technology	273,891.00	34,000
University of Oklahoma	89,092.00	74,750
Fresno State College	108,540.00	
Chico State College	108,510.00	
Stanford University	11,738.00	9,950
Colorado Agricultural and Mechanical College	109,165.00	106,150
Polytechnic Institute of Brooklyn	110,000.00	
University of Texas	74,502.00	74,500
Montana State College	11,260.00	
San Diego State College	181,258.00	
University of Delaware	123,540.00	
Sacramento State College	108,540.00	
Agricultural and Mechanical College of Texas	328,798.00	158,800
Rice Institute	140,420.50	121,350
Clemson Agricultural and Mechanical College	101,768.44	[3] 99,050
University of Tennessee	243,070.00	97,350
University of Nevada	108,540.00	
University of Denver	15,755.00	
University of Connecticut	180,190.00	
San Jose State College	126,940.00	
University of Oregon	17,744.00	15,650
Alabama Polytechnic Institute	289,505.80	74,800
Indiana Technological College	110,000.00	
Iowa State College	190,000.00	
Columbia University	108,240.00	
Clarkson College of Technology	14,124.00	
Spring Hill College	21,880.00	
Case Institute of Technology	33,932.00	
Lehigh University	67,685.50	
University of Missouri	113,262.05	111,900
University of Pennsylvania	76,794.00	41,750
Amherst College	[2]	
University of Toledo	11,260.00	
Fairleigh Dickinson University	8,598.00	
Purdue University	193,573.70	
Utah State University	19,245.00	
State of University of Iowa	85,000.00	
University of Illinois	113,814.75	
Valparaiso University	5,312.50	
State University of New York	11,985.19	
University of Alabama	31,217.87	
University of New Mexico	15,107.00	
University of Arizona	111,186.52	
Kansas State College	340,395.00	

See footnotes at end of table, p. 128.

Proposals received for financial grants to educational institutions—Continued

Institute	Amount of grant requested	Amount of grant awarded [1]
South Dakota State College	$1,425.00	
University of Mississippi	12,530.00	
Tulane University	37,656.50	
University of Virginia	18,898.00	
Tufts University	7,500.00	
Temple University	34,607.00	
Yale University	5,628.00	
Wayne State University	209,613.80	
Muhlenberg College	5,308.00	
University of Akron	22,527.52	
Norwich University	6,500.00	
University of Dayton	3,919.00	
Syracuse University	128,686.50	
Haverford College	[2]	
Wooster College	[2]	

[1] Where no grants were made, proposals are under staff review.
[2] Materials loan.
[3] Clemson Agricultural and Mechanical College has rescinded their acceptance of a grant and check in the amount of $99,050 has been returned to the AEC.

EXAMPLE OF ARRANGEMENTS WITH A TYPICAL SCHOOL

Mr. CANNON. Now will you take a typical school, without giving us the name of the school, and give us the routine which you follow in that school, the basis on which you determine the amount to go to the school, their disposition of that amount, and the reports which they make to you and the extent to which you supervise their work? Also the evaluation at the end of the year of the course as to just how effective this training has been and how successful the school has been in achieving the standards that you are trying to achieve?

Mr. FIELDS. Yes, sir; we will be very glad to.

Dr. LIBBY. We will pick one of the bigger ones as an example, if that is satisfactory.

Mr. FIELDS. Would you like to have us supply that for the record?

Mr. CANNON. Yes, if you will.

Mr. FIELDS. Yes, sir.

(The information follows:)

THE AEC'S EDUCATIONAL PROGRAM AND HOW IT IS ADMINISTERED

PROCEDURES USED IN ADMINISTERING GRANTS PROGRAM

Although the AEC's program of assistance to educational institutions has been widely publicized through press releases, speeches, etc., the usual way that a university initiates contact is through a letter addressed to the AEC requesting information. Following a series of letters and possibly a meeting between one or more members of the university faculty and the AEC staff, in due course, a proposal is submitted by the institution to the AEC.

These preliminary exchanges of correspondence and discussion help to solidify the university's thinking as to the direction it will go. Usually they also serve to point out that the magnitude of the assistance to be made available in large measure depends upon the extent of nuclear competence presently available in the faculty at the universities and the universities' willingness to commit themselves to a major program.

In a number of cases, as a consequence of such informal discussions, and correspondence, the formal proposal when submitted is rather complete. In others, review by AEC staff indicates that certain necessary information has not been included and additional correspondence to obtain the supplementary data takes place.

Appended as attachment A is a sample proposal which covers equipment requested for one course by a large eastern university.

Because the AEC has no way of predicting accurately how many or what proposals will be submitted in the future, proposals are considered in groups rather than as individuals. That is, the Commission will make grants to a large number of institutions at one time rather than considering proposals as soon as received. Proposals, when complete, are subject first to an administrative review. Estimated costs of equipment proposed for purchase by universities are compared against cost data available to the Commission to determine if cost estimates are reasonable; individual items of equipment are reviewed to determine if the proposed size and model of an item of equipment is rugged teaching equipment or fragile, relatively expensive research equipment; the proposal is screened for duplication of equipment and materials and discrepancies are noted, etc.

During this period, when the proposal is receiving administrative review, the university is visited by a staff member of the AEC. This visit is to examine firsthand the facilities already available to the university and to inspect the proposed location of the equipment to be procured by the AEC grant. This visit also serves to acquaint the AEC staff member with the qualifications and ability of the university faculty who will be utilizing the equipment.

Periodically, a review committee of AEC staff meets to review proposals submitted to date. The committee considers such factors as the amount of construction or the degree of financial support being made by the institution, the amount of money available to the AEC for grants, the number of students expected to be served by the course offerings at the university, the magnitude and completeness of the program proposed by the university, the comments of the AEC staff, and other factors which may be pertinent.

The recommendations by the review committee are incorporated into a formally submitted paper to the Commission. Upon approval of the grants by the Commissioners, the schools are notified of the grant by letters similar to that attached as attachment B.

An original and one copy of the grant letters are sent to a duly authorized representative of the university receiving the grant, who upon acceptance of the grant terms, dates and signs the original grant letter and returns it to the Atomic Energy Commission. Upon receipt of the countersigned grant letter, a check is issued to the recipient institution for the approved amount.

The university then proceeds to procure the equipment following their normal procurement procedures. Under the terms of the agreement (par. 1, attachment B), the funds may only be used for the purchase of equipment as described in their proposals of assistance and approved by the AEC. In addition, a report must be submitted detailing the use of the funds supplied by the Commission (par. 7, attachment B).

It is expected that some of the institutions receiving grants will request AEC approval for the use of grant funds for equipment other than that specified in their proposals (par. 1; attachment B). In the event that such a request is received, the proposal will be reviewed and judged on the intended use of the equipment. For instance, if from the time the school submitted a proposal for assistance and the time that the grant was approved, a new and improved version of an equipment item is available on the market and if the intended use of the new item of equipment is for the enhancement of the the curricula in nuclear science and engineering, it is expected that AEC approval would be given for the procurement of the new item. On the other hand, if the new item is such that it is designed primarily as a research tool rather than a training device, the request for substitution would be denied.

In no case has an award to a school been the maximum permitted ($350,000). The program of assistance is a continuing one. As a consequence, it is expected that schools will submit supplementary proposals requesting further assistance up to the maximum allowable. Before such additional awards will be granted, the requesting university will be visited to determine the manner in which the earlier grants have been utilized. This review will be in addition to judgment of the proposed additional programs' worth against criteria used in evaluating the first proposal.

Attachment A

SAMPLE PROPOSAL

Requests for financial assistance in equipping engineering laboratories should be made in a form which clearly demonstrates that the use of the equipment will be for educational purposes. Each laboratory course should be described and all the experiments to be performed in each course should be listed together

with individual reference numbers. The AEC staff will want to know the number of students which can be accommodated by each course and the frequency with which the courses will be offered. The step-by-step procedure should be outlined for each experiment (indicated by the reference number) in each course for which equipment is requested with the equipment itemized. All of the equipment pieces requested should be tabulated together with the quantity, experiments in which use is made (indicated by the reference number), manufacturer and model number (if fabricated by the school this should be stated), and unit price. Which pieces are requested and which pieces are already or will be purchased by the school should be shown.

A sample proposal has been prepared to illustrate a convenient way to present this information to the staff. A course description, a list of the experiments, the outline of one experiment, and a portion of an equipment tabulation is given.

NATIONAL UNIVERSITY

A271

NUCLEAR ENGINEERING LABORATORY I

DESCRIPTION OF COURSE

The general purpose of the course will be to acquaint graduate students of nuclear engineering with the techniques and instruments used directly or indirectly in the operation of nuclear reactors. During the course the student will gain familiarity with the theory and operation of the principal experimental tools, methods, and measuring devices of the nuclear engineer, nuclear physicist, and nuclear chemist. The students will also be given opportunity to work in limited scope research problems as the course develops.

The course will consist of two 1-hour lectures, two 3-hour laboratory periods, and 4 hours of outside work per week. The laboratory course is designed to accommodate 32 students divided into 2 sections of 16 each. Each section will meet twice a week. In general, the students will work together in groups of two on the experiments.

The course is divided into 3 sets of 8 experiments each. The first set of experiments is designed to familiarize the student with the basic detecting and measuring devices for the fundamental particles and rays involved in experimental nuclear engineering. The second set of experiments is designed to indicate the methods and procedures used to determine the properties and behavior of the fundamental particles. The third set of experiments is designed to give the student familiarity with some of the better known methods for determining macroscopic reactor properties and for making chemical separations. Initially the third set of experiments will offer 8 of the 10 experiments listed. Later the list will be revised to exclude those two found least valuable. Eventually it is intended that the experiments involving chemistry will be moved to another course. The experiments will be set up for a period of 4 weeks, except for the last group, which will occupy a 6-week interval.

Initially, at least, the course work will not involve the use of the reactor. It will involve the use of an exponential graphite pile and neutron sources of varying strengths.

INDEX OF EXPERIMENTS, SPRING TERM, 1957

A. Fundamental detection devices
- I. Ionization chambers
- II. Proportional counters, GM tubes
- III. Fission chambers
  - BF_3 counters
- IV. Scintillation detectors
- V. Health physics instruments I
  - Gamma-beta
  - Cutie pie
- VI. Health physics instruments II
  - Fast and slow neutrons
- VII. Electrometer
- VIII. Lauritsen electroscope
  - Cloud chamber (diffusion)

B. Fundamental determinations
- I. Radioactive decay, simple
- II. Range of particles
- III. Reactor criticality determination.
- IV. Absorption of gamma rays
- V. Cross sections, neutron
- VI. Scattering and absorption, thermal neutrons
- VII. Counting statistics
- VIII. Slow/fast neutron ratios

C. Reactor measurements and chemical separation methods
- I. Albedoes of H_2O and paraffin
- II. Diffusion length of thermal neutrons in graphite
- III. Reactor criticality determination
- IV. Moderation of neutrons in graphite
- V. Transport parameter of neutrons in water
- VI. Slowing down of neutrons in water
- VII. Separation of U from fission product activities by solvent extraction
- VIII. Ion exchange separation of cobalt and Ni
- IX. Paper chromatography
- X. Flux distribution in a subcritical reactor

Brief Outline of Proposed Experiments

A. Fundamental Detection Devices

I. IONIZATION CHAMBERS

A. Method

1. Dismantle, examine, and reassemble the ion chamber (containing a thin enriched uranium-235 sample).
2. Evacuate and fill the chamber with argon. Leave the chamber still attached to filling manifold.
3. Connect the chamber to the preamplifier, amplifier scaler, scope, and power supply (or batteries).
4. Count the U–235 alpha particles emitted for 5 minutes and from the count estimate the mass of U–235 present.
5. Observe the pulse shape in the oscilloscope. Add 5 percent CO_2 through the filling manifold and observe again. (Caution—do not allow any air to leak into the chamber.) Disconnect the chamber from the filling line.
6. Place the chamber in the neutron source position as shown by the assistant and bring the neutron source into position. Count fissions, and using the oscilloscope transparent scale estimate their pulse height (one man read pulse height, the other record). Obtain a minimum of 300 counts.
7. Swing the Frisch grid into position and repeat. Plot the pulse height versus number of counts.

B. Equipment

1. Oscilloscope.
2. Ion chamber with enriched U–235 and movable Frisch grid.
3. Preamplifier.
4. Amplifier.
5. Power supply (or batteries).
6. Scaler and timing clock.
7. Filling manifold.
8. Neutron source.
9. Welsh or Cenco forepump and small 2-inch diffusion pump.

(Format for equipment listing under AEC financial assistance program)

NATIONAL UNIVERSITY

Equipment list for Nuclear Engineering Laboratory—A271

Quantity	Item	Experiment			Manufacturer and Model No.	Unit price	Requested from AEC	Purchased by NU	To be purchased by NU
		A	B	C					
x	BF_3 counter, 6"	III	VI	I, III, X	xxx (Mod. x)	$xxx	$xxx	$xxx	$xxx
x	BF_3 counter, 20"		VI		xxx (Mod. x)	xxx		xxx	xxx
x	G. M. end window tubes		I, III	I, II, IV	xxx (Mod. x)	xxx	xxx	xxx	xxx
x	G. M. geometries	As above for G. M. tubes			xxx (Mod. x)	xxx	xxx	xxx	
x	α-β-γ survey meter	V	General use		xxx (Mod. x)	xxx	xxx		
x	Lauritsen electroscope with α, β & γ window.	VIII	IV		xxx (Mod. x)	xxx			
						xxx			
						xxx	xxx		
x	Fast-slow neutron survey meter	VI	General use		xxx (Mod. x)	xxx	xxx		
x	Oscilloscope	I, II, III, IV	General use		xxx (Mod. x)	xxx		xxx	xxx
						xxx	xxx		
x	Scope plug-in preamplifier		As above		xxx (Mod. x)	xxx	xxx	xxx	xxx
x	Viewing hoods for scope		As above		xxx (Mod. x)	xxx	xxx	xxx	xxx
x	Scope dolly		As above		xxx (Mod. x)	xxx	xxx	xxx	xxx
x	Cutie-pie survey meter	V	General use		xxx (Mod. x)	xxx	xxx		
x	G. M. probe			VIII	xxx (Mod. x)	xxx	xxx		
x	Diffusion cloud chamber	VIII			Const. at N. U		xxx	xxx	
x	Miscroscope lamp for cloud chamber	VIII			xxxx (Mod. x)	xxx			
	Extra bulb					xxx	xxx		
	Batteries	I, V, VI, VII, VIII.	II		Various		xxx	xxx	xxx
x	Fission counter	III				xxxx	xxx		

Revised 5/6/57

ATTACHMENT B

UNITED STATES ATOMIC ENERGY COMMISSION

Washington 25, D. C.

SAMPLE GRANT FORM

Subject: Grant No. ————

Dear Sir: I am pleased to inform you that the sum of $———— is hereby granted by the AEC to the ———— for the purchase of the following listed equipment and materials to be used in the educational and training program specified in your proposal dated————, 1957.

(To be itemized: a, b, c, etc.)

The following are conditions of the grant:

(1) The funds may only be used for the purchase of the above-specified equipment and materials or equivalent, as delineated in your proposal of ————, 1957, unless prior approval of the AEC has been received.

(2) The equipment must be used in an educational and training program of the type specified in your proposal dated ————, 1957.

(3) This grant terminates one year from the effective date unless otherwise extended by the AEC. This grant may be revoked in whole or in part by the AEC after consultation with the grantee.

(4) In the event of revocation or at the termination of the grant, whichever is earlier, funds not utilized by the grantee prior to that time for the purposes contemplated under this grant shall be returned to the AEC.

(5) The disposition of any patents or inventions or discoveries resulting from the use of equipment or materials purchased with monies given under this grant shall be the responsibility of the licensee, *provided* that the grantee shall grant the Government an irrevocable, royalty-free, non-exclusive license for use of such inventions or discoveries for governmental purposes. To the extent that the Commission has any rights in such inventions or discoveries pursuant to Section 152 of the Atomic Energy Act of 1954, the Commission hereby waives such rights.

(6) The grantee shall be deemed to have waived all claims for damages under Section 183 of Title 35 U. S. Code by reason of the imposition of any secrecy order on any patent application, and all claims for just compensation under Section 173 of the Atomic Energy Act of 1954, with respect to any invention or discovery made or conceived in the course of or in connection with work performed with funds made available under this grant.

(7) The grantee shall submit a report, certified by a duly authorized officer of the institution, to the Commission within one year of the date of acceptance of this grant, detailing the use of the funds supplied by the Commission for the equipment and summarizing the educational and training program undertaken in connection with the equipment supplied by the Commission.

(8) The grantee agrees that no person shall be barred from participation in the educational and training program involved or be the subject of other unfavorable discrimination on the basis of race, creed, color, or religion.

(9) Nothing in this grant shall be deemed to constitute a license.

(10) Title to any equipment or material purchased with these funds shall vest in the grantee.

(11) This grant does not relieve the grantee from complying with the Atomic Energy Act of 1954 and the regulations issued pursuant thereto, including any requirements for permits or licenses.

To permit us to complete arrangements for transfer of funds to your institution, please acknowledge acceptance of the grant subject to the aforementioned

conditions by signing in the space provided below and return the *original* of this letter.

Sincerely yours,

W. KENNETH DAVIS,
Director, Division of Reactor Development.

Accepted by:

_____
(Duly Authorized Officer—Signature)

_____
(Name—Typed)

_____
(Title)

_____
(Institution)

_____
(Date)

TECHNICAL INFORMATION

Mr. CANNON. Why do you need this additional million dollars' worth of technical information next year, which is the amount you ask for in addition to the amount provided in the current year. Why couldn't you obtain satisfactory results with the amount you received in 1957?

Dr. LIBBY. We think our program in adult education in the technical education field is one of the most important activities we carry on. This is the way we can get people to put the atom to work themselves by getting the information that we have had locked up in our vaults and which we recently have declassified out into the public domain. We have a tremendous amount of information that has been declassified in the last months, and we have the job of getting this out.

Mr. CANNON. The program is entirely satisfactory up to this time?

Dr. LIBBY. The program is very satisfactory. We are very proud of it.

Mr. CANNON. You accomplished it this year at the expense of $2,134,000, and you are asking for $3,190,000. Why is it necessary to secure that increase if your program has been successful and satisfactory up to this time?

Dr. LIBBY. The volume of material is increasing all the time.

Mr. CANNON. Do you mean the volume of material, or do you mean the number of schools?

Dr. LIBBY. No, sir. This is information which we are publishing in the form of books, periodicals, and things of this sort.

Mr. CANNON. And the number of schools in which you install equipment has nothing to do with that?

Dr. LIBBY. That is right. This is general information.

Mr. CANNON. To whom is that information made available?

Dr. LIBBY. To everyone. It is in the public domain.

Mr. CANNON. It has been completely declassified.

Dr. LIBBY. Yes, sir. It is open and public. The only thing is that it is a big job to get the secret reports and get them out so people can get their hands on them.

Mr. CANNON. You find an interest in the public for this material?

Dr. LIBBY. It is tremendous. We think to keep up with the demand we need this money.

Mr. FIELDS. Mr. Chairman, this is not all unclassified information. There is a good part of it that is. We have technical information services, because of the widespread nature of our program. That is the heart of this program, so that we understand the developments and the impact of them in one area and another area. There is a good deal of this that has to be done.

Mr. CANNON. Just who does have access to this classified information?

Mr. FIELDS. The individuals who have the appropriate clearance for this kind of material within our program, and the access permittees in industry who have been given permits for access to this information on a security basis. They have access to a great deal of it.

Mr. CANNON. How do you screen these applicants?

Mr. FIELDS. They have to submit an application. They are screened carefully. They have to actually pay for their own security clearances. We go through the same procedure with them as with our own personnel.

Mr. CANNON. There is no possibility in the routine which you have established to protect this classified information that a part of it may be going abroad?

Mr. FIELDS. I think we taking every precaution we can, and I think it is adequate on the classified material. Obviously the unclassified information is published and available for purchase at the Government Printing Office or elsewhere.

Mr. CANNON. You are establishing foreign depository libraries?

Mr. FIELDS. Those are unclassified.

Mr. CANNON. That is only unclassified material.

Mr. FIELDS. Yes, sir. We do have some classified library depositories in some of our major centers in the United States, and the primary purpose is for access by these access permittees, as well as for universities which conduct classified work.

Mr. RABAUT. Those classified books in different parts of the United States that you have referred to, are they permitted to be taken from the depository where they are?

Mr. FIELDS. No, sir. They are not.

In the access permit program, if the permittees have secure storage, which has been inspected by us, there are occasions where they will be allowed to take it there. That is just the same as our own offices. I don't think that this occurs with great frequency. We sell them to them normally.

Mr. RABAUT. You mean they can take them out as a purchased item?

Mr. FIELDS. They would normally get those from the Technical Information Services at Oak Ridge where the permittee can purchase these documents.

Mr. RABAUT. You know what the carelessness is that occurs with books sometimes?

Mr. FIELDS. Yes, sir. We have inspected their facilities and cleared their facilities for classified storage. We reinspect them and follow through with them as we do at our own installations.

ATOMS-FOR-PEACE PROGRAM

Mr. CANNON. I have just one question at this point. What is the amount you propose to spend in the furtherance of the atoms-for-peace program?

Mr. FIELDS. Within this appropriation, Mr. Chairman, in a broad sense this whole training and education program is a part of the atoms-for-peace program. This is the major part of what I would ascribe to our expenditures for the atoms-for-peace program.

Mr. CANNON. The atoms-for-peace program has a very definite objective.

Mr. FIELDS. Yes, sir.

Mr. CANNON. And it is very carefully circumscribed. You certainly know what amount is spent for that program except for your commitment to support it.

Mr. FIELDS. Yes, sir. The reason that I say that this is a part of it is that there is training for foreign students, there are fellowships, conferences, and that kind of thing in our training and education program. So you could say a good part of the items we are discussing today is for the atoms-for-peace program.

Secondly, in the Mutual Security Act there is an amount of $7 million requested for authorization and appropriation, which would be for atoms-for-peace program. That would involve some grants toward the purchase of research reactors and some assistance in plans for the programs in foreign countries. That, however, is not in our budget.

Then whatever would be appropriated to the International Atomic Energy Agency activities in conjunction with the participation of this country I presume would be atoms-for-peace program, too. That, however, would not be an item for which the Atomic Energy Commission would be requesting appropriations.

Mr. CANNON. General Fields, the atoms-for-peace program has been very widely sold to the public.

Mr. FIELDS. Yes, sir.

Mr. CANNON. I suppose it has, incident to its very name, a very wide appeal. I am a little surprised with your lack of familiarity.

Mr. FIELDS. I wanted to make a positive answer to you, sir. I did not want to omit any item. We have not pulled together in our appropriation a category titled "Atoms-for-Peace Program." That is the only reason I was hesitating.

I wanted to make sure I had indicated every program that does contribute toward this.

We do have a program in conjunction with our bilateral agreements with foreign countries where we will sell or lease fissionable material to them. But when these are effected they will be under regular lease agreements where they will either pay a lease charge, or there is the probability of their actually paying us for the material in accordance with the schedule of charges under which we have offered to sell this material. A very big part of the program is, the furnishing of the material to enable foreign powerplants to be built and to function.

Mr. CANNON. The committee is interested in this program because the public is interested in it. We are very anxious to have detailed information on it. We will appreciate it if you will supply

for the record a detailed breakdown of how you propose to support this program.

Mr. FIELDS. Yes, sir, I will be happy to.

(The information follows:)

ATOMS-FOR-PEACE PROGRAM SUMMARY FOR HOUSE APPROPRIATIONS COMMITTEE

I

Peaceful applications of atomic energy were given worldwide impetus by the proposals made by the President before the United Nations General Assembly in December 1953. The effort resulting from these proposals has come to be known as the atoms-for-peace program.

In the 3½ years that have elapsed, the United States has clearly established its leadership in pressing vigorously a wide-ranging program to achieve the broad goal of making the atom the servant of mankind. Substantial results have been achieved.

A number of Government agencies have participated in this effort. The Atomic Energy Commission and the Department of State have had the major responsibility for carrying out the atoms-for-peace program. The International Cooperation Administration and the United States Information Agency have played vital supporting roles.

At the outset, the Commission concentrated on revision of the Atomic Energy Act to establish a legal basis for international cooperation in the nuclear field. The Department of State had to combat the initial negative reaction of the Soviet Union to the idea of an international atomic agency. USIA put into motion a worldwide campaign, using all types of mass mediums to bring to the millions, who viewed the atom only with terror or despair, realization of its peaceful potential.

The 1954 Atomic Energy Act became law in August of that year. All divisions of the Commission that could assist were directed to give the atoms-for-peace program a high priority. Recruitment for specially skilled personnel needed began, and in 1955 the Office of International Affairs was raised to division status and later an Assistant General Manager for International Activities was appointed.

When the U. S. S. R. realized that the United States would press forward with plans for an international agency, it revised its previous policy and began to cooperate. It has supported the United States position on the all-important safeguards problem in the long and tedious negotiations on the statute of the International Agency. It participated fully in the historic United Nations Atomic Energy Conference in Geneva in 1955.

Perhaps the best index to the effectiveness of this program is that the Soviet Union has organized an atoms-for-peace program of its own and has made large claims for assistance given and planned for its satellites. To date, the U. S. S. R. has not challenged seriously United States leadership in this field among the friendly and uncommitted nations.

Substantial evidence has accumulated that the information campaign of the USIA was effective in building United States leadership in the atoms-for-peace effort. The program has proven a valuable tool in removing the "warmonger" label that communistic propaganda had been using with telling effect since 1956.

II

Paralleling its support of the Department of State's efforts to secure agreement on an international agency, the Commission formulated and is carrying out a comprehensive international cooperation program which is achieving concrete results. This program is based primarily on a system of bilateral agreements of cooperation in the civil uses of atomic energy with friendly nations.

These agreements provide: (1) for mutual beneficial exchange of technical data; (2) for the lease or sale of fuel for nuclear reactors; (3) guaranties against diversion of any materials to nonpeaceful uses; and (4) for accountability reports and inspection commensurate with the scope of each agreement to assure that both signatories to an agreement would be able to detect attempts at misuse or diversion of nuclear materials.

These agreements fall into two categories: (1) Those for research provide for the lease of fuel for research reactors and the availability of research quan-

tities of highly enriched U–235, U–233, and Pu. The maximum amount of contained U–235 made available is 12 kilograms.

The power agreements provide generally for the sale on a government-to-government basis of fuel for power demonstration and power reactors. Prior to major declassification of technical data in December 1956, these power accords provided, under prudent safeguards, for the exchange of classified information on nuclear power. Since December 1956, power bilaterals have been negotiated on an unclassified basis.

To date, negotiations have been conducted for 49 agremeents with 43 countries. (Some nations have or will have two agreements—research and power bilaterals.) Of these, 37 are now in effect; 28 are research bilaterals and 9 are power agreements.

In most cases, there has been sustained activity by our friends to avail themselves of the assistance authorized by these agreements. A few already had civilian atomic-energy programs underway. Most of the others have organized atomic energy commissions in one form or another and are making extensive studies for the adaptation of peaceful applications of nuclear energy according to their needs and resources.

It takes considerable time for these new organizations to be able to make decisions regarding the acquisition of a research reactor which are valuable to training and research programs. It takes at least a year to design and manufacture such a reactor. In the case of nuclear powerplants the elapsed time, from design to operation, will run 5 years or more. This technical lag has led some to believe that little is being done under the atoms-for-peace program. In truth, the opposite is the case. Briefly, these activities may be summarized as follows:

1. Training

Lack of trained scientists, engineers, and technicians is the single greatest obstacle in the path of progress toward practical uses of nuclear energy. In the spring of 1955, the United States opened the International School for Nuclear Science and Engineering primarily to afford foreign nationals the opportunity for training in basic reactor technology. The fifth of these 34-week courses is now nearing completion, and 216 students from 41 nations have been enrolled. Through cooperation with North Carolina State College and Pennsylvania State University, the capacity of these classes was doubled from 60 to 120.

Many of the graduates of the first courses already are holding important positions in the civilian nuclear programs of their respective countries. The training given foreign nationals has been supported through ICA grants to visiting students.

Two sessions of the 28-day radioisotope training course at Oak Ridge, Tenn., were given over to foreign students and 15 percent of the enrollment in other courses is allocated for such students. Through June of this year, 173 foreign students from 39 countries had received this training.

2. Dissemination of information

The historic atomic-energy conference at Geneva in August 1955, is perhaps the greatest single event in the entire program to date. We are sure that your committee is quite familiar with the massive contribution made by United States scientists and engineers to this meeting, which reopened many avenues of scientific communication that had been closed since 1939. The commission is now planning for United States participation in the Second Geneva Conference scheduled for September 1958.

The University of Puerto Rico is being provided technical and scientific assistance in setting up a nuclear training center which will provide Spanish-language instruction and which would be available to students from the American Republics.

An Inter-American symposium held at the Brookhaven National Laboratory in May brought 101 scientists, engineers, and administrators from the American Republics together for a week of discussion and exchange of information. A consultive atomic energy organization is being created within the Organization of American States as a result of the recommendations of the Committee of Presidential Representatives.

Technical experts from the Commission and its contractors have participated in symposiums in Britain, Belgium, and Tokyo. Numerous conferences with Great Britain, Canada, and Belgium have been held in which information was exchanged on a classified basis.

The Commission also organized with ICA support technical missions which have visited the Far East and South America to assist countries in these areas in planning programs for peaceful application of atomic energy.

Unclassified basic and applied nuclear data has been organized into well-balanced technical libraries. To date these libraries have been given to 47 nations, the city of West Berlin, and 4 international organizations. A continuing program of keeping this data up-dated is in effect.

3. Person-to-person contacts

Perhaps most significant in the long view has been the visits to this country for discussions with the Commission, its contractors, and American industry, of leading scientists, engineers, industrialists, and government leaders from other nations. Since the beginning of 1955, there have been more than 1,800 of these visitors from 72 nations.

4. Sale of reactors

As a result of this varied effort, American industry has taken the lead in supplying reactors to those nations having bilateral agreements with us. Two American-made research reactors are in operation in Switzerland and the Netherlands, and another in Japan went critical this month. American firms are designing and building seven more research reactors. Negotiations for the design and manufacture in this country of at least a dozen more are in various stages. Design is underway for an American-made power reactor in Belgium and discussions are in progress with seven other nations looking toward the placing of contracts for nuclear power facilities.

III

With the deposit of United States ratification of the statute of the International Atomic Energy Agency on July 29, 1957, that organization came into existence. Plans are underway for United States participation in the first general conference of the agency scheduled to open in Vienna on October 1.

We believe it is fair to say that United States leadership is responsible for the creation of the International Atomic Energy Agency. In cooperation with several friendly powers, a draft statute was circulated to all prospective members in August 1955. The United Nations in December 1955 renewed its support first expressed in a unanimous General Assembly vote in December 1954. In April of last year, a 12-nation working group in Washington hammered out a complete statute. On October 26, 1956, at the conclusion of a conference on the statute, 80 nations initialed the completed document. President Eisenhower, in congratulating this conference, pledged that the United States would make available to the agencies, as needed and on mutually agreeable terms, 5,000 kilograms of U–235 and would match contributions in nuclear materials by other members through July 1, 1960. The United States has exercised leadership in the Preparatory Commission of the agency created by this conference. The Preparatory Commission has been at work on the actual organization and program of the International Atomic Energy Agency.

IV

Three other important items should be mentioned in this brief summary. Grants of $350,000 each, made from International Cooperation Administration, have been approved for 7 nations toward the cost of construction of their initial research reactor projects. This is in accordance with an offer made by the President on July 11, 1955.

The International Cooperation Administration has the responsibility for implementing the United States offer of assistance in establishing a nuclear training center in the Philippines for the nations of Asia and south Asia.

Shipments of special nuclear material now being made as required for research reactors represent the first actual drawing on the total of 50,000 kilograms of U–235 made available by Presidential directives for use in research and power reactor programs abroad.

In closing, we believe that the atoms-for-peace program has maintained and enhanced the United States leadership in the cause of peace, and has made real progress toward the long-range goal of bringing the benefits of the peaceful atom to the peoples of all nations.

The funds included in the Commission's fiscal year 1958 budget specifically identifiable for its portion of the atoms-for-peace program are set forth below:

Prorata portion of operation of Argonne School of Nuclear Science and Engineering	$575,000
Prorata portion of radioisotope courses at Oak Ridge Institute of Nuclear Studies	43,000
Operation of Puerto Rican Training Center:	
Operating expenses	300,000
Construction obligations	2,500,000
Expenses of international conferences and studies	2,850,000
Technical libraries	97,500
Salaries and expenses of Division of International Affairs and Office of Special Projects, including foreign offices and foreign travel	1,300,000
Total	7,665,500

TRAINING AIDS FOR HIGH SCHOOL TEACHERS

Mr. RILEY. On page 160, Mr. Fields, in the allocation for training of high school science teachers, is that aid restricted to radiobiology?

Dr. LIBBY. No, sir.

Mr. RILEY. What other courses are open to the high-school teacher? I ask that question because I understand from the college people that the difficulty they have in the training of scientists is the lack of fundamental teaching in the high schools? Is that right?

Dr. LIBBY. That is right. We have to help the high-school teachers learn this new subject matter. It is no criticism of the high-school teachers, because nobody knew it a few years ago when they were in school. So we have, with the National Science Foundation, a program of helping them. It is not only in radiobiology but in the use of radioisotopes, for example, and the facts about the atom.

This summer we have approximately 100 high-school teachers taking courses jointly which the National Science Foundation and AEC support at Duke, Harvard, the University of New Mexico, Wayne State University, and the University of California at Los Angeles.

Mr. RILEY. Is that largely a summer course?

Dr. LIBBY. It is a summer course. In addition, we plan to have 10 teachers next year who will learn to be teachers of teachers and travel around with a truck and trailer and show exhibits and give demonstrations. They spend the whole year doing this, traveling all over the country. This program has been very helpful.

Mr. RILEY. Do you have a good many applications for these courses?

Dr. LIBBY. We certainly do. I would like to ask Mr. Kaufmann, or Dr. Shilling, to give the number.

Dr. SHILLING. I have just visited two of these high school training courses, and also what we call the station wagon course that Commissioner Libby just mentioned. It is a very effective program. In specific answer to your question, the number of applicants was between 100 and 200, depending on which one of the 5 schools you take, and only 20 could be chosen because of the limitation of space and training facilities for them. The training of the high school teachers for travel is interesting because it is cooperative with five difference groups working on it. The Atomic Energy Commission furnishes money for operation of the school at the Oak Ridge Institute

of Nuclear Studies. The National Science Foundation furnishes the stipends and family allowances for the high-school teachers who travel for the full year. The Ford Motor Co. furnishes the station wagons, the Gulf Oil Co. furnishes the gasoline for it, and the Oak Ridge Institute itself furnishes money from the universities.

These programs will eventually be self-supporting. Already 12 States have said, if you will take our representative for next year, we will pay all expenses. So I look forward to the time, so far as this training is concerned, when it will be picked up by the logical sources, namely, the States. But in the meantime it is one of the most effective programs it has been my privilege to be associated with. It is real fun to visit these training centers. The teacher-students are extremely enthusiastic. They have been able to sell this program very widely to other science teachers. The program is catching on nicely. I think it is the best money I have spent in my 28 years in the Navy and now 2½ years in Atomic Energy. It is a very, very effective program.

Mr. RILEY. Is it not a little disconcerting, if I understood your figures, to realize that less than a fifth of the applicants are able to get the course?

Dr. SHILLING. There are many other schools. The National Science Foundation is running 100 such summer institutes. They can get special courses in mathematics, in chemistry, in biology. We are trying to do our little bit in the circumscribed area of radiobiology. It happens to be exceedingly popular, because as Commissioner Libby has said, it is an area in which no one has had a chance to learn before. We would like to do more but it seems to me with what we are asking for next year we will be able to do 16 such summer institutes, and this will be the nucleus from which we can spread out.

Actually they are doing a good seeding job. In Detroit the superintendent of schools, for example, complained that all of his science teachers now want additional equipment and additional training since one person took the course at Harvard. This is what we hope will happen every place, and it is beginning to happen there.

Dr. LIBBY. In addition to this program, we have other things which follow more or less a suggestion you made last year, Mr. Jensen. For example, on February 11, last on Edison's birthday, we had 4,400 high-school students visit various Commission installations all over the country. They came with their teachers. Again, we have our people in our various laboratories and in our contractors' facilities help the high-school science teachers and students in any way they can on a local basis. This is a difficult thing to tabulate and write down in numbers, but I assure you that it has been a very fruitful program. Also the cost has been very small.

Mr. RILEY. The program appeals to me. I do not know how it appeals to the other members of the committee, but I am wondering if we could not better spend some of the money which is programed for other purposes on extending this particular program.

Dr. LIBBY. It is possible. As you see, we intend to increase it pretty rapidly. We have a host of supporting activities. For example, we passed out this year over 11,000 information kits. These are just little kits explaining about the atom and they went to elementary and high-school students and teachers. We have movie films which are

very popular, which are kept at our various installations over the country, and which can be borrowed. I have forgotten the exact number, but several thousand showings of these films have been made.

So we have a great many things other than just the matters we mentioned about the training of high-school teachers. The training of high-school teachers is a very important thing. We are trying to increase it. Maybe we should increase it more.

Mr. RILEY. You will develop more sources for your scientists.

Dr. LIBBY. That is right.

Mr. RILEY. To me that is one of the most important things in this program, that is, to develop the knowledge and continue the work. I think you have just scratched the surface. Thank you, Mr. Chairman.

OPERATION OF SCHOOLS BY THE COMMISSION

Mr. EVINS. Mr. Commissioner, how many schools does the Atomic Energy Commission itself operate, other than the Oak Ridge National Laboratory?

Dr. LIBBY. We operate just the Argonne School, I believe.

Mr .EVINS. You operate the two?

Dr. LIBBY. Yes, sir.

Mr. EVINS. How many is the Commission contributing to overseas in the way of education?

Mr. FIELDS. We are contributing to none at the present time.

Mr. EVINS. You spoke of your program for next year as to how much you are going to implement training overseas to provide more knowledge to people in Europe and elsewhere.

Mr. FIELDS. But the money we have requested for training funds for that purpose is for the operation of these schools, Mr. Evins, or the proposed school at Puerto Rico. We have no money that goes to the operation of schools in foreign countries.

Mr. EVINS. You expect to bring them over here and train them here?

Mr. FIELDS. That has been our practice, yes, sir, except for the Purto Rican school which we are now proposing.

Dr. LIBBY. Of course, Mr. Evins, the information program, these books and things, are a great help to technical education everywhere.

Mr. EVINS. I understand you are contributing libraries of information to some 40 countries.

Mr. FIELDS. We have done that.

Mr. EVINS. You maintain two schools and you are now proposing to build a third school in Puerto Rico.

Mr. FIELDS. Yes, sir.

TRAINING OF UNITED STATES CITIZENS

Mr. EVINS. We are all interested in international conferences. I am not isolationist minded. We need all the education possible, but satisfy my mind as to how we are going to keep ahead in this science of the atom if we are training others more than our own. Why don't we just emphasize the training in our own country?

Mr. FIELDS. Mr. Evins, the schools we have here in the United States are not exclusively for foreign students. There are students from the United States, industry and so forth.

Mr. EVINS. I understand that. But I get the impression that you are going to accelerate your training in the foreign field.

Dr. LIBBY. Not more than our domestic. The Oak Ridge Institute of Nuclear Studies is for Americans. This whole program of putting the universities in the business is important. We think in the Commission that the Commission should not go into the schoolteaching business unless it has to. Our general purpose is to assist the schools to do the job.

COOPERATION WITH NATIONAL SCIENCE FOUNDATION

Mr. EVINS. I understand. I am all for assisting the schools in this country. I want us to stay ahead and keep ahead. On another subcommittee on which I serve, the Independent Offices, we have the National Science Foundation and they described to us a program almost identical to that you have described here about the traveling lecture program. It seems to me you are rather duplicating the same type of mobile-education program.

Can you not concentrate in one area and the National Science Fundation in another?

Dr. LIBBY. The National Science Foundation has a much broader charter than we have. It covers the whole field of science.

Mr. EVINS. I understand. Their budget is up five times over what it was in this field of education.

Mr. FIELDS. I would like Dr. Shilling to speak to that point.

Dr. SHILLING. The traveling lectureship program, the station-wagon program, is financed by the National Science Foundation. Our contribution is very small compared to theirs. They finance the whole program. The high-school training program which we have a part in is limited to radiation biology and they furnish a large part of that. It is a cooperative program.

Mr. EVINS. Do you go separately in your training or do you go jointly with them?

Dr. SHILLING. Jointly. We don't have anything that is not cleared with them. As a matter of fact, we work daily with them and we pick up only pieces of it.

Mr. EVINS. I think that is to be commended.

Mr. FIELDS. Would you like me to supply you with the arrangements there, Mr. Evins?

Mr. EVINS. I think it might be helpful if we had that.

(The information follows:)

JOINT AEC–NSF PARTICIPATION IN EDUCATION AND TRAINING PROGRAM

(a) *Traveling high school science lecture program.*—The National Science Foundation made a contract with the Oak Ridge Institute for Nuclear Studies for the training of carefully selected high school science teachers. These teachers were to be made available for a full year for visiting high schools, upon invitation, and presenting science demonstrations and lectures. The course has been extremely beneficial and popular, so much so that 12 States have requested that they be allowed to send a candidate this coming year for whom

they will pay all of the expenses. It is our hope that eventually, the States may assume the responsibility for the entire program, except for the part assumed by the AEC in furnishing the laboratory and lecture space and the instructors.

In 1957, the cooperative effort was, as follows:

Agency	Amount of funds, fiscal year 1957	Form of participation
National Science Foundation.	$115,800	Stipends and family allowance; 9 months traveling costs; summer training costs; selection of teacher-students.
Oak Ridge Institute for Nuclear Studies.	54,856	New demonstration equipment; reconstruction of old equipment; overhead costs.
Division of Biology and Medicine.	15,000	Miscellaneous for this program, and other training activities.
Ford Motor Co		10 station wagons.
Gulf Oil Co		Gas and oil to operate the 10 station wagons for 9 months.

(*b*) *Radiobiology training for high school science teachers.*—Because the high school science teacher is in a key position to interest young people in careers in science and engineering, the Division of Biology and Medicine is providing special training in radiobiology for high school science teachers.

Contracts to conduct 8-week courses for selected high school science teachers were made with Harvard University, Duke University, University of New Mexico, University of Los Angeles, and Wayne State University for the summer of 1957.

The curriculum includes both lecture and laboratory sessions emphasizing radiobiology, radioisotopes, and nuclear science. In addition, refresher courses in mathematics, physics, biology, and related science subjects are offered as necessary.

In each of the five universities the selection of candidates, the granting of academic credits, and the evaluation and followup of the effectiveness of the graduates are under the jurisdiction of the participating institution's department or school of education. Selection of 20 candidates at each university for the 1957 courses was made after a careful evaluation of the professional records of the applicants for the courses. The interest and enthusiasm for this training is shown by the fact that several hundred applicants were received from high school science teachers by each university for the 20 available appointments.

Upon successful completion of the course, each high school science teacher is given a demonstration kit containing simple radiation detection and measuring equipment, a radioactive source and other basic pieces of equipment to enable him to demonstrate the newly acquired techniques to the science students at his own and neighboring schools.

This program is cooperative with the National Science Foundation in that the NSF furnishes the stipends for the students and the family allowances. For fiscal year 1957, this amounted to—

Agency	Amount of funds, fiscal year 1957	Form of participation
Atomic Energy Commission	$200,000	For equipment and operation of the institutes.
National Science Foundation	97,500	Stipends and family allowances.

A detailed report of this cooperative program appears in the Commission's 22d semiannual report.

INCREASE IN TRAINING, EDUCATION, AND INFORMATION PROGRAM

Mr. EVINS. Doctor, I am sure from your testimony and that of the other Commissioners that you feel you should step up the program of training and education and information you should step it up from $8,800,000 to $17,500,000, about double for next year.

Dr. LIBBY. Yes, sir. This is our judgment. In my opinion it is the most important job the Commission has. It is hard to be sure about these numbers, but I think in view of our experience that this increase is well justified.

Mr. EVINS. We know it is important, but, in view of the Bureau of the Budget's directive to hold the line to 1957, do you not think that you could maintain this program along the line of 1957?

Dr. LIBBY. We certainly could, but we would have to turn many people away and restrict our activities over what I think would be a desirable growth—a very desirable growth. We have no doubts about this. This increased program should be done. I think that money spent here has a bigger return than in almost any other place we can spend it.

Mr. EVINS. How much do you plan on accelerating the Oak Ridge Institute of Nuclear Studies? Is it $370,000?

Dr. LIBBY. The numbers are on page 157.

Mr. EVINS. $370,000 more there.

Mr. FIELDS. Not more, sir. That amount of $370,000 is the total.

PUERTO RICAN TRAINING CENTER

Mr. EVINS. Your largest increase is the establishment of the Puerto Rican center?

Dr. LIBBY. Yes, sir; that is entirely new. We have nothing there now.

Mr. EVINS. I think that is all, Mr. Chairman. Thank you.

Mr. RABAUT. There are several reasons for the Puerto Rican installation. One reason would be the language of South America.

Dr. LIBBY. Yes.

Mr. RABAUT. You would gather your students from South America for that work.

Mr. FIELDS. Yes.

(Discussion off the record.)

USE OF TELEVISION AS A TEACHING AID

Mr. RABAUT. I was very pleased to hear you say that some of this teaching is being done through television. You know there are teachers and there are teachers. There are many people that have the knowledge of the subject but have difficulty imparting their knowledge to another. When you can get a teacher that can really impart his knowledge and put him on television—you have a tremendous influence in hurrying your program along. I think you ought to concentrate your thoughts on that. That is something that would really save a lot of money and get your information out in a more rapid manner.

Dr. LIBBY. I certainly agree with you, Mr. Rabaut. Walt Disney had a movie—I don't know whether you saw it or not—on the atom which we did not have anything to do with directly, but which was a very good thing. It is a 1-hour movie and was shown nationally on the TV; a very sound movie on the atom. This is certainly a very valuable technique.

Mr. CANNON. Mr. Magnuson.

UTILIZATION OF TRAINED PERSONNEL

Mr. MAGNUSON. What becomes of these students who are trained in the colleges? Does the Commission aspire to employ most of them or part of them?

Dr. LIBBY. They go to work in our atomic power installations for the contractors who are working in this field. They are pretty generally employed in this way. Are you speaking of the the foreign students, sir, or the domestic?

Mr. MAGNUSON. The domestic.

Dr. LIBBY. As I said, they go to work for the people who are building the atomic powerplants and for us in our laboratories.

Mr. MAGNUSON. You have no particular hold on them?

Dr. LIBBY. No, sir.

Mr. MAGNUSON. It is purely voluntary.

Dr. LIBBY. Yes. In order to obtain this special training, a year or so of their lives is spent taking these courses, so they have shown a real interest in the field. This year we have 117 students who are going to school beginning this fall on fellowships for which you gave us money last year, and which we are asking money for again this year. We think this fellowship program is a very good one. These students will, I believe, without exception, go to work on atomic power or closely related activities—because the opportunities are so great and the atomic-power development is so interesting. I believe the return will be very high. We will know better in a year or so.

FAMILY ALLOWANCES FOR HIGH SCHOOL TEACHERS ATTENDING SUMMER INSTITUTES

Mr. MAGNUSON. With respect to these summer institutes in radiation biology for high-school teachers, did I understand you to refer to family allowances in that connection?

Dr. LIBBY. Dr. Shilling mentioned that.

Dr. SHILLING. Yes, sir. The National Science Foundation furnishes those It is part of their program in this sense. The high-school science teacher is a very low paid individual. Many of them have to run gas stations in the summer. What they have done in order that they make certain that they come in for all of their different educational programs is to furnish a stipend and a small family allowance. It amounts to $15 per dependent up to a maximum of 5 per week for the 8-week period. We do not furnish that.

Mr. MAGNUSON. Regardless of who furnishes it, is that with a view to their taking their families with them to the school or maintaining their families during their absence?

Dr. SHILLING. Either way. They get the allowance whether they take the families to the school or not. Most of them do not, because the schools do not have housing facilities. It is simply a maintenance of the family while the man gets this special training.

Mr. MAGNUSON. I am glad to hear that. I think that is the way it should be.

Dr. SHILLING. Of the 20 I met last night, only 3 had families with them. It was costing them a good deal more than the allowance to bring the families, but they brought them because of the chance for the ocean.

SELECTION OF TEACHERS TO ATTEND SUMMER INSTITUTES

Mr. MAGNUSON. How are these teachers selected? I noticed you said that the number of applicants greatly exceeds the capacity. Is it on a competitive basis?

Dr. SHILLING. Yes, sir. In each case the department of education at the university, working with the State department of education, picks from the list of volunteers on the basis of recommendations from the superintendent and on the basis of recommendations from the State department of education on the record of the individual—a transcript of his record is actually reviewed for his proficiency—and actually they have to be reasonably proficient in physics and chemistry and biology and mathematics before they can take the 8-week course. It is a rugged course. Last year in one case the people were not selected properly. This year they have selected very high caliber people because the idea is to have them pass the education on to others.

Mr. MAGNUSON. How about the age factor?

Dr. SHILLING. We do not select extremely old people who are anywhere near the retirement age, because we will not get our money's worth out of them; this may not be fair to the older ones, but in the interest of passing the information on, the oldest person at the installations I have just visited was 52. She was one of the outstanding science teachers in the State.

Mr. MAGNUSON. That is all, Mr. Chairman.

RESTRICTION OF EXPENDITURES TO FISCAL YEAR 1957 LEVEL

Mr. CANNON. Let me ask one general question that I intended to ask at the beginning.

At the conclusion of our last hearing we asked you to consult with the Director of the Budget, Mr. Brundage, and ask him if he expected to adhere to the budget as submitted this year, or if he expected to stay within the instructions received some time ago to keep expenditures within the 1957 figures. I take it for granted you have discussed the matter with him, and we would be glad to know what his reply was.

Mr. FIELDS. We did see him, Mr. Chairman. We discussed the question with him. We transmitted to you a copy of a letter that he had forwarded to us on this subject. I understand he appeared before this committee. He recognizes, it is my interpretation, that our 1958 budget has to exceed our 1957 amounts because of the commitments in raw materials, the production of special nuclear materials, the production of weapons, and the expanding civilian programs. There were no savings that were apparent at the time of our discussions. The only way we could see to reduce our costs would be by discontinuing some programs, and he agreed with us that we were not aware of any that could be discontinued. That is my interpretation of the conference, Mr. Chairman.

Mr. CANNON. Did he still adhere to his instructions that you should restrict to the 1957 budget?

Mr. FIELDS. He emphasized that to the extent feasible we were to make savings in our program as it went forward, Mr. Chairman.

Mr. CANNON. Does that choice remain with you? Is it up to you to decide what is feasible or does he decide what is feasible?

Mr. FIELDS. I presume he would make a review of our apportionment request which would go to him following the passage of the budget. Our apportionment request would go forward on the basis of this budget that is here before us, Mr. Chairman. I don't see in view of the conversation that we had that there are any programs that can be discontinued or that would be markedly changed from what is in this budget.

Mr. CANNON. How do you account for the fact that he issued this letter directed to this activity and this agency individually?

Mr. FIELDS. I don't believe he did it to this agency individually. We did get a specific letter, Mr. Chairman.

Mr. CANNON. I understand that the letter that went out was not identical to all the agencies of Government, but he addressed to each agency a letter which was intended to apply to that particular agency.

Mr. FIELDS. I assume so, yes, sir.

Mr. CANNON. We would like to know, if we make this appropriation, whether we should make it on the basis of what is asked in 1958 or what is expected to be spent in the 1957 budget?

Mr. FIELDS. I can only repeat, Mr. Chairman, as a result of the conference, my interpretation is that he recognized that we cannot hold to the 1957 level of expenditures because of the commitments on raw materials, the production of weapons and the other programs that are outlined in this budget.

Mr. CANNON. However, when you finally receive your allocation, you do not know whether the allocation will be made on the basis of the 1957 or 1958 budget. He reserves that right?

Mr. FIELDS. I can't be certain of that. As I understand the process, he reserves the authority to review our budget at the time that the apportionment is requested.

Mr. CANNON. You understand that leaves us in a very doubtful and uncertain position. The budget is not firm. We are not certain that in the allocation it will not be reduced or increased.

ACTUAL COSTS FOR FISCAL YEAR 1957

Mr. TABER. I would like to ask a question, if I might, Mr. Chairman. If this does not meet with your approval, I would like to have you say so. I would like to have you take these pages that you are putting in the record out of the book and give us the actual costs for 1957 in each table. Can you do that? Would that be satisfactory to the chairman?

Mr. CANNON. Yes. I think that should be done by all means.

Mr. FIELDS. I believe we can do that, Mr. Taber.

Mr. TABER. I think that would be of some help in our approach.

Mr. FIELDS. We will do that, Mr. Chairman. I am informed they will not vary much from the estimate because these estimates were revised very recently.

Mr. CANNON. We will ask you to do that when you revise your remarks.

Mr. FIELDS. Yes, sir, that will be for each program.

Mr. CANNON. Yes, sir, a detailed estimate.

Mr. FIELDS. I understand, Mr. Chairman.

Mr. CANNON. We also will ask you that in the event the amount is less than the 1958 budget, also give us your estimate as to where the reduction should be made. In other words, in the event it is below the 1958 budget, show us in what specific items the reduction should be made.

Mr. FIELDS. This will be apparent since we will give you a tabulation by activities.

(The following information was subsequently supplied.)

Comparison of actual fiscal year 1957 costs with fiscal year 1957 costs shown in the fiscal year 1958 budget

[In thousands]

	In Budget	Actual
A. Raw materials program:		
1. Exploration	$7,466	$7,204
2. Procurement of source materials	395,620	391,327
3. Process development	3,116	2,964
4. Equipment not included in construction projects	461	488
Total, raw materials program	406,663	401,983
B. Special nuclear materials program:		
1. Procurement and production	553,383	550,246
2. Process development	33,337	32,770
Total, special nuclear materials program	586,720	583,016
C. Weapons program	318,740	323,487
D. Reactor development program:		
1. Civilian power reactors	53,775	54,212
(a) Government program	(51,781)	(52,752)
(b) Cooperative arrangements program	(1,994)	(1,460)
2. Army power reactors	2,457	2,882
3. Naval propulsion reactors	66,300	71,758
4. Aircraft propulsion reactors	85,543	82,998
5. Merchant ship reactors	664	875
6. Controller thermonuclear project (project Sherwood)	11,000	10,735
7. Advanced engineering and development	9,252	9,775
8. Reactor safety	3,409	3,588
9. Separations systems development	9,018	8,882
10. Operational services	5,772	3,221
11. Equipment not included in construction projects	17,523	17,756
Total, reactor development program	264,713	266,682
E. Physical research program:		
1. Isotope process development	356	330
2. High energy physics	12,930	12,937
3. Nuclear structure and neutron physics	10,631	9,980
4. Extranuclear properties of matter	683	947
5. Design and development of devices for physics research	3,377	3,515
6. Physical methods of isotopes separation	570	520
7. Computer development and mathematics research	979	486
8. Process chemistry	4,877	5,033
9. Classified project A	1,199	1,221
10. Chemical properties and reactions	11,889	12,541
11. Chemical isotope separation studies	532	577
12. Production, treatment, and properties of materials	2,052	1,948
13. Alloy theory and the nature of solids	3,443	2,918
14. Effects of irradiations on materials	1,170	1,195
15. Equipment not included in construction projects	5,964	5,221
Total, physical research program	60,652	59,369
F. Biology and medicine program:		
1. Radiation effects on biological systems	10,552	10,893
2. Combating radiation detrimental effects	1,980	1,962
3. Beneficial applications of atomic energy	8,978	8,890
4. Biomedical problems in atomic energy operations	6,687	6,669
5. Dosimetry and instrumentation	2,329	1,882
6. Equipment not included in construction projects	1,072	1,017
Total, biology and medicine program	31,598	31,313

Comparison of actual fiscal year 1957 costs with fiscal year 1957 costs shown in the fiscal year 1958 budget—Continued

[In thousands]

	In Budget	Actual
G. Training, education and information program:		
1. Operation of schools	$1,416	$1,147
2. Fellowships	850	617
3. Assistance to schools	4,207	3,564
4. International conferences and studies	220	21
5. Technical information	2,134	2,175
6. Equipment not included in construction projects		135
Total, training, education, and information program	8,827	7,659
H. Community operations program:		
1. Oak Ridge, Tenn	8,006	7,923
2. Richland, Wash., community operations	5,068	4,943
3. Richland, Wash., assistance payments	165	79
4. Los Alamos, N. Mex	4,417	4,445
5. Sandia, N. Mex	315	300
6. Grand Junction, Colo	96	88
Total, community operations program	18,067	17,778
I. Program direction and administration:		
1. Personal services	30,465	30,016
2. Travel	2,010	1,969
3. Other objects	5,424	5,757
4. Equipment not included in construction projects	399	315
Total, program direction and administration	38,298	38,057
J. Security investigations	8,916	8,442
K. Other costs:		
1. Cost of special reactor materials	3,874	2,502
2. Cost of isotopes	1,770	1,213
3. Cost of other products	10	1,398
4. Cost of services	663	854
5. Cost of security investigations	1,218	1,052
Total, other costs	7,535	7,019
Total, gross costs	1,750,729	1,744,805
L. Less revenues applied:		
1. Revenue from sale of products and services (related costs are included under program "other costs"):		
(a) Special reactor materials	7,090	4,471
(b) Isotopes	2,213	2,816
(c) Other products	25	1,318
(d) Services	809	1,136
(e) Security investigations	1,311	1,304
	11,448	11,045
2. Other revenues (related costs are included under applicable program costs):		
(a) Sale of special nuclear materials and vanadium pentoxide	3,225	2,371
(b) Tuition Income	345	403
(c) Research hospital income	257	353
(d) Income from museums and exhibits and sale of publications	50	60
(e) Community	18,630	18,988
(f) Miscellaneous Income	2,182	2,182
	24,689	24,357
Total, revenues applied	36,137	35,402
Total net costs	1,714,592	1,709,403
M. Selected resources:		
1. Inventories:		
(a) Stores	−3,268	1,545
(b) Special reactor materials	16,080	17,348
(c) Other special materials	−4,655	182
(d) Isotopes	471	994
Total inventories	8,628	20,069
2. Collateral funds	−1,100	−848
3. Goods and services on order	39,413	53,541
Increase in selected resources	46,941	72,762
Grand total obligations	1,761,533	1,782,165

MONDAY, AUGUST 12, 1957.

Mr. CANNON. The committee will be in order.

At the time we last adjourned, we were discussing operating expenses and the training item. Mr. Taber was about to inquire.

Mr. TABER. With reference to page 155, did you bring in the record of expenditure for 1957?

Mr. CANNON. We have it for all activities.

Mr. MCCARTHY. Yes. These amounts are somewhat preliminary. We do not have all the final reports in, but the expenditures on this program are about $7.7 million.

Mr. TABER. Out of an appropriation of $8.8 million?

Mr. MCCARTHY. That is correct, sir. There are, however, some minor adjustments which will probably be made in the final report.

INCREASES REQUESTED FOR 1958

Mr. TABER. You are asking for $17.5 million for the program.

Mr. MCCARTHY. For the new fiscal year; yes, sir.

Mr. TABER. That represents an increase in assistance to schools of about $4.5 million, about $300,000 for operation of schools, fellowships $165,000, and international conferences and study $1,650,000?

Mr. FIELDS. No, sir; the latter is an increase of $2,630,000.

Mr. TABER. Yes. On the technical information, you roughly have a million dollars.

Mr. FIELDS. Yes, sir.

Mr. TABER. Why do you need such a big increase?

ASSISTANCE TO SCHOOLS

Mr. FIELDS. In the item of assistance to schools, there is an increase of $3,890,000 for grants of training equipment and other assistance, for engineering and medical schools, to assist in a buildup in the training of graduate students in these fields, so that we will obtain a higher number of graduates in these fields. This monetary increase will permit us to increase the number of schools to which grants would be given by an additional 60, so that we would be supporting about 94 schools in fiscal 1958 compared to about 34 in fiscal 1957.

Mr. TABER. How many new students do you expect to have?

Mr. FIELDS. As a target, we will provide for training of 2,000 students per year by 1962.

Mr. TABER. That is 2,000 per year.

Mr. FIELDS. Yes. This is students at the universities.

Mr. TABER. Is the assistance to schools a capital item?

Mr. FIELDS. It is a grant for the procurement of equipment. It does not carry a continuing obligation on our part to support the cost of operation.

Mr. TABER. Is it a one-time grant?

Mr. FIELDS. Yes, sir. However, we may wish to request additional funds for grants in subsequent fiscal years, but these would not be for the operation of the equipment.

Mr. TABER. How much of the $4,207,000 did you use in fiscal 1957?

Mr. MCCARTHY. The amount used in fiscal 1957 was $3,600,000, Mr. Taber.

Mr. TABER. Do you have any idea that you will actually get as far as the $8,700,000 in this fiscal year? You are not getting your money until the 1st of September. You realize that, do you not?

Mr. FIELDS. I realize that; yes, sir. Our estimate is that we could still obligate that amount.

Mr. TABER. What kind of machinery is it?

Mr. FIELDS. It consists of electronic equipment, component parts for reactors, such as experimental heat transfer equipment, small experimental training reactors, and items of that nature. It is very specialized equipment for radiation or reactor engineering studies. It does not include buildings, typewriters, furniture, or items of this nature.

INTERNATIONAL CONFERENCES AND STUDIES

Mr. TABER. You have international conferences and studies, with an increase of $2,630,000. How much did you spend in 1957?

Mr. MCCARTHY. Mr. Taber, I do not have the breakdown for that particular item. I doubt if there was too much spent. It would be of the order of a couple of hundred thousand dollars.

Mr. FIELDS. In fiscal 1957 we did not have an international conference of the nature of the one for which we are asking support in fiscal 1958. There is an international conference of the Geneva type scheduled for next September. Most of the increase is requested for the support of this new conference. At the previous international conference our expenditures were in the neighborhood of $2 million. Included in the estimate is an amount for an exhibition at that conference.

Mr. TABER. The objective of that conference will be what?

Mr. STRAUSS. Perhaps Mr. Taber, I might speak to that. The first conference in the summer of 1955 was held at the instance of the United States for the purpose of disseminating unclassified information on the peaceful uses of atomic energy. It was a highly successful conference. It was attended by a good many Members of both Houses of Congress, all of whom were very complimentary with respect not only to the overall effects of it, but to the scope of and the conduct of our own exhibits. It was the first time in many years that scientists from all parts of the world could come together in a common forum, and it was agreed that the results were so good that it should be repeated at the interval of about 2 years.

Mr. TABER. This last conference was held when?

Mr. STRAUSS. In August of 1955, and the next conference will take place in September of 1958, an interval of 3 years.

Mr. TABER. Why would you need this money before July 1, 1958?

Mr. STRAUSS. The exhibits have to be prepared. For example, at the conference in 1955, we built a reactor—a swimming-pool reactor—and flew it to Geneva and erected it in a building specially prepared for that purpose on the grounds of the old League of Nations and later sold it to the Swiss Government. These exhibits and preparations will take nearly a year to perfect and so it is not too early to start even now.

TECHNICAL INFORMATION

Mr. TABER. What about the technical-information business, with a million-dollar increase? How much did you spend on that?

Mr. MCCARTHY. The technical-information program covers the publication of material which has been declassified, Mr. Taber, for issuance to industry and to the public.

Mr. TABER. How much did you spend in 1957?

Mr. MCCARTHY. That ran roughly $2 million. I do not have the exact figure.

Mr. TABER. Why would you need more than you had in the last fiscal year?

Mr. MCCARTHY. The main reason for the increase is because of the program which has been going on in the past year to declassify a lot of the technology and which will now be available for publication. This is really a printing bill, Mr. Taber.

FELLOWSHIPS

Mr. TABER. Are you still expecting 279 people, as indicated on page 158?

Mr. MCCARTHY. In the fellowship program?

Mr. TABER. Yes.

Mr. MCCARTHY. It appears this is a good estimate as of the moment. The applications will be coming in shortly.

INTERNATIONAL CONFERENCES AND STUDIES

Mr. TABER. Now, this item of $2,850,000; there seems to be no comparable figure that we can go by.

Mr. FIELDS. On the International Conference, sir?

Mr. TABER. Yes.

Mr. FIELDS. We have some comparable figures for the Geneva Conference in 1955.

Mr. TABER. How much was that?

Mr. MCCARTHY. The cost of that in fiscal year 1955 was $2,392,000. The expenditures occurred mainly in fiscal 1955. The Conference took part in the first quarter of 1956. The planning and preparation of the exhibit and the preparation and printing of papers to be delivered at the Conference constitute the bulk of the costs and are incurred a year in advance of actually holding the Conference.

Mr. TABER. How much did you spend in 1955?

Mr. MCCARTHY. For that Conference it was $2,392,000, including about $800,00 for the exhibit.

Mr. TABER. Most of it is to be spent abroad or for the benefit of the peaceful use of atomic energy abroad?

Mr. FIELDS. It is not to be spent abroad necessarily. As Mr. McCarthy indicated, it will be for the preparation of the papers, the planning and direction of this Conference and the exhibits that would be set up by the United States. This money would actually be spent in the United States. There will be some travel, some per diem and items of that nature which would be spent abroad in conjunction with our delegation.

Mr. TABER. I think that is all I have for the time being.

Community Program

Mr. Cannon. We will insert pages 163 through 185 at this point in the record.

(The justification follows:)

Community Program—Operating Costs

Program statement

Estimate, fiscal year 1958	$16,515,000
Estimate, fiscal year 1957	18,067,000
Decrease	1,552,000

The community program provides for housing and commercial facilities, utilities, hospitals, and municipal facilities and services in the AEC controlled and operated communities of Oak Ridge, Tenn.; Richland, Wash.; and Los Alamos, N. Mex. These operations are carried out principally under cost-type contracts. Commercial facilities are operated by private enterprise through lease or concession agreement. Housing and utilities are provided also for project-connected employees at Sandia, N. Mex., and certain locations in the States of Colorado and Utah.

The estimates reflect the impact of disposal legislation on the communities of Oak Ridge, Tenn.; and Richland, Wash.; as authorized under the Atomic Energy Community Act of 1955. The disposal schedules for real estate are based on the assumptions provided by the Housing and Home Finance Agency, the Agency assigned responsibility for the real-estate disposal activities at Oak Ridge, Tenn.; and Richland, Wash. Details of the disposal schedules which reflect a substantial accomplishment of disposal by end of fiscal year 1958 are included in the following pages. The reduction in cost of $1,552,000 is due primarily to the projected sales of housing and commercial properties with a resultant decrease in operation and maintenance cost of real estate.

The current estimate contemplates incorporation of the communities and transfer of municipal installations and facilities subsequent to fiscal year 1958 with the exception of the Richland Hospital. Provision is made in the estimate for payment of assistance payments to the Richland Hospital under the provisions of chapter 9, Public Law 221, for fiscal years 1957 and 1958, and continuing annual contributions to the Richland School District under the authority of the Atomic Energy Act of 1954, until the schools are transferred to the Richland School District.

The estimated excess of costs over revenue of $1,636,000 is directly related to the decrease in income from housing and commercial properties at Oak Ridge, Tenn.; and Richland, Wash., and the continued operation of municipal functions, with their related costs, by the Commission until the communities are incorporated.

The revenues from community operations are included under the budgetary item, "Revenues applied," as a reduction in the "Operating expenses" appropriation. A summary comparison of community operating costs and revenues, exclusive of services provided production facilities, is shown in a table on the following page. Tables of operating cost and revenue by category for each community are included in the pages following.

Summary of community program costs and revenues

	Actual, fiscal year 1956	Estimate, fiscal year 1957	Estimate, fiscal year 1958
Operating costs:			
Oak Ridge, Tenn	$8,516,862	$8,006,000	$7,241,000
Richland, Wash., community operations	5,779,805	5,068,000	4,112,000
Richland, Wash., assistance payments	0	165,000	200,000
Los Alamos, N. Mex	4,054,228	4,417,000	4,538,000
Sandia, N. Mex	329,168	315,000	343,000
Grand Junction, Colo	90,783	96,000	81,000
Total operating costs	18,770,846	18,067,000	16,515,000
Revenues (budgeted under "Revenues applied"):			
Oak Ridge, Tenn	8,967,235	7,662,000	5,356,000
Richland, Wash	6,506,335	5,790,000	4,199,000
Los Alamos, N. Mex	4,482,376	4,629,000	4,773,000
Sandia, N. Mex	443,579	454,000	454,000
Grand Junction, Colo	63,259	95,000	97,000
Total revenues	20,463,284	18,630,000	14,879,000
Net operating costs:			
Oak Ridge, Tenn	−450,373	344,000	1,885,000
Richland, Wash	−727,030	−557,000	113,000
Los Alamos, N. Mex	−428,148	−212,000	−235,000
Sandia, N. Mex	−114,411	−139,000	−111,000
Grand Junction, Colo	27,524	1,000	−16,000
Total	−1,692,438	−563,000	1,636,000

OAK RIDGE, TENN.

The fiscal year 1958 estimates for Oak Ridge are based on continued operation and maintenance by the AEC of all municipal facilities and utilities, with no transfer of any of these functions to local entities before the end of fiscal year 1958. However, the sale of real property will be in progress during fiscal year 1957 and fiscal year 1958, resulting in a reduction in operating costs and revenues on real estate, and a related increase in municipal revenues. These estimates are based on Housing and Home Finance Agency's estimated sales of 40 percent of single and duplex housing and 20 percent of nonresidential property in fiscal year 1957, and 40 percent of single and duplex housing and 60 percent of nonresidential property in fiscal year 1958.

No assistance payments to a local entity will be required in fiscal year 1958 since it is assumed that municipal installations and activities, schools, the new hospital, and the electrical, water, and sewerage utilities will not be transferred under the Atomic Energy Community Act of 1955 to other entities before the end of fiscal year 1958. It is possible that Oak Ridge will elect not to incorporate until calendar year 1959, at the earliest, and that transfer of facilities and responsibilities would not be effected until fiscal year 1960, or shortly before the expiration of the 5-year period under section 83 of Public Law 221.

Additional details supporting the estimates are presented in four tables on succeeding pages, as follows:

1. Table I showing costs, revenues, and net operating costs by category.
2. Table II reflecting the assumptions with respect to the sale of properties under Public Law 221.
3. Table III showing net loss of revenue resulting from property sales.
4. Table IV showing the assessed valuation for municipal service charge purposes of properties expected to be sold by the end of fiscal year 1958.

TABLE I.—*Community operating costs, Oak Ridge, Tenn.*

	Actual, fiscal year 1956	Estimate, fiscal year 1957	Estimate, fiscal year 1958
Operating costs:			
(a) Municipal	$3,648,484	$3,636,000	$3,623,000
(b) Utilities	729,760	793,000	950,000
(c) Real estate	2,311,654	1,885,000	1,030,000
(d) Hospital	1,220,232	1,240,000	1,240,000
(e) Property disposal	443,643	288,000	281,000
(f) Equipment	163,089	164,000	117,000
Total operating cost	8,516,862	8,006,000	7,241,000
Revenues (budgeted under revenues applied):			
(a) Municipal (including tax equivalent revenue)	521,095	628,000	753,000
(b) Utilities	1,474,196	1,493,000	1,623,000
(c) Real estate	5,780,904	4,330,000	1,769,000
(d) Hospital	1,191,040	1,211,000	1,211,000
Total revenue	8,967,235	7,662,000	5,356,000
Net operating costs:			
(a) Municipal	3,127,389	3,008,000	2,870,000
(b) Utilities	−744,436	−700,000	−673,000
(c) Real estate	−3,469,250	−2,445,000	−739,000
(d) Hospital	29,192	29,000	29,000
(e) Property disposal	443,643	288,000	281,000
(f) Equipment	163,089	164,000	117,000
Total Oak Ridge	−450,373	344,000	1,885,000

TABLE II.—*Commission-owned private-use properties for sale under Public Law 221, Oak Ridge, Tenn.*

Property type	Estimated number of units remaining unsold [1]					
	July 1, 1956	June 30, 1957	Fiscal year 1957 average [2]	July 1, 1957	June 30, 1958	Fiscal year 1958 average [2]
Residential:						
Single and duplex housing	5,194	3,073	4,338	3,073	952	2,012
Apartments	1,998	1,958	1,990	1,958	1,148	1,610
Dormitories	15	15	15	15	15	15
Vacant and privately developed residential land [3]	1,597	1,251	1,512	1,251	322	786
Subtotal residential	8,804	6,297	7,855	6,297	2,437	4,423
Commercial, nonprofit, and nonresidential	176	158	173	158	76	117
Grand total	8,980	6,455	8,028	6,455	2,513	4,540

[1] Units of property shown on this and the following schedule are defined as follows: Single and duplex housing units and apartment units are the number of family or living quarters; domitory units are the number of dormitory buildings; and all other units are the number of sales parcels.

[2] Averages for the fiscal year are derived from a more detailed scheduling by quarters of estimated sales. Since the volume of various types of sales vary considerably by quarters in keeping with the estimated progress of various phases of the sales program, these averages differ substantially from a "straight line" average in many instances.

[3] Types of vacant land found in this category are sec. 57a lots, vacant lots and other vacant parcels. "Privately developed residential land" consists of title VIII and title IX land.

TABLE III.—*Net loss of revenue resulting from property sales, Oak Ridge, Tenn.*

	Single and duplex housing	Other residential	Commercial and nonprofit	Total
FISCAL YEAR 1957				
Assuming sale of 40 percent single and duplex housing, and 20 percent commercial and nonprofit property:				
Rental revenue [1]	$971,232	$17,625	$26,733	$1,015,590
Tax equivalent revenue [2]	89,179	9,696	2,772	[3] 101,647
Difference	882,053	7,929	23,961	913,943
Reduction in operating and maintenance costs after sale	120,120	1,000	16,357	137,477
Net loss in revenue	761,933	6,929	7,604	776,466
Increase over fiscal year 1956 net costs				[4] 794,000
FISCAL YEAR 1958				
Assuming sale of 40 percent single and duplex housing, and 60 percent commercial and nonprofit property:				
Rental revenue [1]	2,972,232	28,625	586,733	3,587,590
Tax equivalent revenue [2]	226,559	17,988	24,689	[3] 269,375
Difference	2,745,673	10,637	562,044	3,318,215
Reduction in operating and maintenance costs after sale	862,120	1,000	129,357	992,477
Net loss in revenue	1,883,553	9,637	432,687	[4] 2,325,738
Increase over fiscal year 1956 net costs				2,335,000

[1] Amount that would have been collected if the property had not been sold.
[2] Charge for municipal services made to purchasers of property.
[3] See table IV, municipal services charges.
[4] The differences between the net loss in revenue and net costs are the result of minor changes in costs and revenues.

TABLE IV.—*Assessed valuation for municipal service charge purposes (Public Law 221, sec. 55c) of Commission-owned properties, Oak Ridge, Tenn.*

Property type	Sold through fiscal year 1957			Sold through fiscal year 1958 (cumulative)		
	Units	Assessed value [1]	Municipal service charge [2]	Units	Assessed value [1]	Municipal service charge [2]
Residential:						
Single and duplex housing	2,121	$9,269,593	$88,750	4,242	$18,768,569	$210,676
Apartments	40	72,390	429	850	1,718,962	15,883
Dormitories	0	0	0	0	0	0
Vacant and privately developed residential land	461	840,892	9,696	1,390	1,595,245	17,988
Subtotal, residential	2,622	10,182,875	98,875	6,482	22,082,776	244,547
Commercial, nonprofit and nonresidential	18	469,454	2,772	82	2,262,520	24,828
Grand total	2,640	10,652,329	101,647	[3] 6,564	24,345,296	[3] 269,375

[1] Assessed value is 100 percent of the FHA appraised valuation of the Commission-owned lands and buildings sold under the disposal program.

[2] For calendar year 1956, a tax rate of $1.185 per $100 was established in accordance with sec. 55c of Public Law 221, which requires that rates shall be comparable to those prevailing in nearby communities. This same rate has been used for fiscal years 1957 and 1958 in preparing these estimates, although the statute requires that the rate be reexamined in conformance with locally prevailing rates each year. (In making the comparison with locally prevailing rates, differences in local practice in determination of assessed value were taken into consideration.) Unlike the situation at Richland, the schools at Oak Ridge are considered a part of the municipal services, and therefore there is no separate levy to support the school.

[3] Estimated municipal service charges (the equivalent of taxpayments) shown on this schedule are only on Commission-owned properties sold under the disposal program. Municipal service charges or tax equivalent revenues are also collected on privately constructed residences and commercial buildings and facilities. This charge is in accordance with lease provisions so long as the land on which the facilities are located is leased from the Commission. After the land has been purchased from the Commission, the privately constructed facilities thereon bear the same municipal service charge as described in footnote 2.

Reconciliation between the municipal service charge on Commission-owned properties sold, and the total budget estimate for tax equivalent revenues is as follows:

	Fiscal year 1957	Fiscal year 1958
Commission-owned properties sold (from table IV)	$102,000	$269,000
Privately constructed commercial center	44,000	25,000
Title VIII and title IX housing	80,000	67,000
All other private construction	46,000	39,000
Total tax equivalent revenue	272,000	400,000

RICHLAND, WASH.

The fiscal year 1958 estimates for Richland, Wash., are based on continued operation and maintenance by the AEC of municipal facilities, with the exception of the Kadlec Hospital and the community telephone system. It is currently contemplated that incorporation of the Richland community will take place after fiscal year 1958. Therefore, no assistance payments to a municipal entity will be required in fiscal year 1958. The estimates are based on the Housing and Home Finance Agency's disposal plan which estimated sales of 5 percent of single and duplex housing and 20 percent of nonresidential property in fiscal year 1957, and 45 percent of single and duplex housing and 20 percent of nonresidential housing in fiscal year 1958.

Assistance payments will be made in fiscal year 1957 and fiscal year 1958 to the Methodist Board of Homes and Hospitals as a result of the transfer of the Kadlec Hospital to the board in September 1956, under the provisions of Public Law 221. The letter contract with the hospital board provides for the Atomic Energy Commission to make periodic payments to cover its monthly operating deficit, subject to an agreed-upon ceiling. The contract also provides for renegotiation of the method to be used in calculating assistance payments when the hospital board has had enough operating experience to utilize a formula in lieu of the operating deficit to compute payments.

The Richland School District is already established as a political unit in the State of Washington and receives annual contributions from the AEC under

the authority provided in the Atomic Energy Act of 1954. The fiscal year 1958 budget estimates are prepared on the assumption that this type of financial assistance will continue through fiscal year 1958, and the transfer of school facilities will not occur, and related assistance payments under provisions of the Atomic Energy Community Act of 1955 will not be made until after fiscal year 1958.

It is also assumed that the community telephone system will be sold under the provisions of chapter 7, Public Law 221, to the General Telephone Co. on or about April 1, 1957.

Community gross operating costs decrease $921,000 in fiscal year 1958 primarily due to disposal of real estate and utilities with resultant elimination of operating and maintenance cost. Net operating cost for fiscal year 1958 indicates a deficit of $113,000 for fiscal year 1958 as compared to an operating surplus of $557,000 for fiscal year 1957. The reason for the fiscal year 1958 deficit is primarily due to the loss of rental revenue from the sale of property as detailed in schedules on the following pages.

Additional details supporting the estimates are presented in four tables on succeeding pages, as follows:

1. Table I—showing costs, revenues, and net operating costs by category.
2. Table II—reflecting the assumptions with respect to the sale of properties under public law 221.
3. Table III—showing net loss of revenue resulting from property sales.
4. Table IV—showing the assessed valuation for municipal service charge purposes of properties expected to be sold by the end of fiscal year 1958.

TABLE I.—*Community operating costs, Richland, Wash.*

	Actual, fiscal year 1956	Estimate, fiscal year 1957	Estimate, fiscal year 1958
Operating costs:			
(a) Municipal (exclusive of schools)	$1,393,763	$1,487,000	$1,540,000
Schools	718,818	841,000	665,000
(b) Utilities	711,398	643,000	489,000
(c) Real estate	1,776,330	1,682,000	1,253,000
(d) Hospital	865,142	180,000	0
(e) Property disposal	284,981	168,000	152,000
(f) Equipment	29,373	67,000	13,000
(g) Assistance payments (hospital)	0	165,000	200,000
Total operating cost	5,779,805	5,233,000	4,312,000
Revenues (budgeted under "Revenues applied"):			
(a) Municipal (exclusive of schools)	140,760	145,000	214,000
Schools	0	0	0
(b) Utilities	1,496,549	1,428,000	1,149,000
(c) Real estate	4,236,596	4,097,000	2,836,000
(d) Hospital	632,930	120,000	0
Total revenue	6,506,835	5,790,000	4,199,000
Net operating cost:			
(a) Municipal (exclusive of schools)	1,253,003	1,342,000	1,326,000
Schools	718,818	841,000	665,000
(b) Utilities	−785,151	−785,000	−660,000
(c) Real estate	−2,460,266	−2,415,000	−1,583,000
(d) Hospital	232,212	60,000	0
(e) Property disposal	284,981	168,000	152,000
(f) Equipment	29,373	67,000	13,000
(g) Assistance payments	0	165,000	200,000
Total, Richland	−727,030	−557,000	113,000

TABLE II.—*Commission owned private use properties for sale under Public Law 221 Richland, Wash.*

Property type	Estimated number of units remaining unsold [1]					
	July 1, 1956	June 30, 1957	Fiscal year 1957 average [2]	July 1, 1957	June 30, 1958	Fiscal year 1958 average [2]
Residential:						
Single and duplex housing	5,825	5,534	5,752	5,534	2,913	4,005
Apartments	144	144	144	144	144	144
Dormitories [3]	27	27	27	27	27	27
Vacant and privately developed residential land [4]	290	290	290	290	290	290
Subtotal residential	6,286	5,995	6,213	5,995	3,374	4,466
Commercial, nonprofit, and nonresidential	154	146	152	146	138	141
Telephone system [5]	1	0	1	0	0	0
Grand total	6,441	6,141	6,366	6,141	3,512	4,607

[1] Units of property shown on this and following schedules are defined as follows: Single and duplex housing units and apartment units are the number of family or living quarters; dormitory units are the number of dormitory buildings; and all other units are the number of sales parcels.
[2] Averages based on the number of units remaining unsold at the end of each quarter fiscal year.
[3] Of the 27 dormitory structures, 16 are being used as dormitories, 4 are being used as office and classroom space, and 7 are in standby.
[4] Units of property in this category include vacant residential lots and 2 parcels of land with title VIII housing.
[5] For completeness of inventory the telephone system is included in this table.

TABLE III.—*Net loss of revenue resulting from property sales, Richland, Wash.*

	Single and duplex housing	Other residential	Commercial and nonprofit	Telephone	Total
FISCAL YEAR 1957					
Assuming sale of 5 percent single and duplex housing and 20 percent commercial and nonprofit property:					
Rental revenue	$44,250	0	$24,000	$90,000	$158,250
Tax equivalent revenue	1,406	0	520	2,063	3,989
Difference	42,844	0	23,480	87,937	154,261
Reduction in operation and maintenance costs after sale	17,250	0	5,400	52,500	75,150
Total	25,594	0	18,080	35,437	79,111
Increase over fiscal year 1956 net costs					170,000
FISCAL YEAR 1958					
45 and 20 percent:					
Rental revenue	1,106,250	0	156,000	360,000	1,622,250
Tax equivalent revenue	71,312	0	1,328	8,254	80,894
Difference	1,034,938	0	154,672	351,746	1,541,356
Reduction in operation and maintenance costs after sale	431,250	0	35,100	210,000	676,350
Increase over fiscal year 1956 net cost	603,688	0	119,572	141,746	865,006
Increase over fiscal year 1956 net cost					840,000

TABLE IV.—*Assessed valuation for municipal service charge purposes (Public Law 221, sec. 55c) of Commission-owned properties, Richland, Wash.*

Property type	Sold through fiscal year 1957			Sold through fiscal year 1958 (cumulative)		
	Units	Assessed value [1]	Municipal service charge [2]	Units	Assessed value [1]	Municipal service charge [2]
Residential:						
Single and duplex housing	291	$535,000	$1,406	2,912	$5,350,000	$71,312
Apartments	0	0	0	0	0	0
Dormitories	0	0	0	0	0	0
Vacant and privately developed residential land	0	0	0	0	0	0
Subtotal residential	291	535,000	1,406	2,912	5,350,000	71,312
Commercial, nonprofit, and nonresidential	8	354,000	520	16	885,406	[3] 1,328
Telephone system	1	550,000	2,063	1	550,000	8,254
Grand total	300	1,439,000	[4] 3,989	2,929	6,785,406	[4] 80,894

[1] The assessed value is 25 percent of the FHA appraised value of Commission-owned property sold under the disposal program.

[2] The tax rates at Richland are 14 mills for schools and 15 mills for municipal services, which are the local prevailing rates, and therefore are in compliance with sec. 55c. For comparison with Oak Ridge, the assessed valuation of 25 percent of FHA appraised value, coupled with a combined rate of 29 mills, is the equivalent of a rate of $0.725 per $100 of full valuation, as contrasted with $1.185 per $100 for the same services at Oak Ridge.

[3] Property in this category already is subject to the 14-mill school tax rate. The new municipal service charge shown here is for the 15-mill municipal revenue only.

[4] Privately owned residences and commercial buildings also pay the municipal service charge. (See the following reconciliation table.)

	Fiscal year 1957	Fiscal year 1958
Commission-owned properties sold (from table IV)	$3,989	$80,894
Title VIII housing	67,000	67,000
All other private construction	19,011	11,106
Total tax equivalent revenue	90,000	159,000

LOS ALAMOS

The community of Los Alamos, N. Mex., is an isolated, self-sustained community which was built and is currently maintained to support the research and development efforts of the Los Alamos Scientific Laboratory. Average population during fiscal year 1956 was 12,696 and will increase to approximately 13,735 in fiscal year 1958. The increase in municipal costs primarily reflect additional school costs resulting from a raise in teachers salaries and a rising students enrollment. Average daily atendance is expected to go from 3,030 in fiscal year 1956 to 3,317 in fiscal year 1957 and to 3,681 in fiscal year 1958. Another increment in municipal costs is due to pay increases for contract employees who staff such municipal services as street and ground maintenance and waste disposal. Cost for utilities will increase in fiscal year 1957 and fiscal 1958 because of a higher level of operations; however, these increased costs will be more than offset by increased revenues. Real estate costs increases in fiscal year 1957 and fiscal year 1958 are attributable to maintenance deferred from fiscal year 1956, a higher level of preventive maintenance, and an increase in the number of housing units. Increased equipment costs are to provide for the replacement of refrigerators and stoves under the cylical maintenance program. The increase in revenue during fiscal year 1957 and fiscal year 1958 is a direct result of the housing construction program which increases revenues for housing rentals and utilities.

	Actual, fiscal year 1956	Estimate, fiscal year 1957	Estimate, fiscal year 1958
1. Gross cost:			
(a) Municipal	$1,201,262	$1,346,000	$1,420,000
(b) Utilities	679,676	721,000	736,000
(c) Real estate operations	1,360,447	1,433,000	1,510,000
(d) Hospital	676,158	682,000	679,000
(e) Equipment	136,685	185,000	193,000
Total gross costs, Los Alamos	4,054,228	4,417,000	4,538,000
2. Revenue (budgeted under "Revenues applied"):			
(a) Municipal	15,801	16,000	16,000
(b) Utilities	1,235,314	1,284,000	1,315,000
(c) Real estate operations	2,772,760	2,870,000	2,983,000
(d) Hospital	458,501	459,000	459,000
Total revenue, Los Alamos	4,482,376	4,629,000	4,773,000
3. Net:			
(a) Municipal	+1,185,461	+1,330,000	+1,404,000
(b) Utilities	−555,638	−563,000	−579,000
(c) Real estate operations	−1,412,313	−1,387,000	−1,473,000
(d) Hospital	+217,657	+223,000	+220,000
(e) Equipment	+136,685	+185,000	+193,000
Net, Los Alamos	−428,148	−212,000	−235,000

SANDIA

Sandia constitutes a small AEC community of 1,487 residents located within Sandia Base at Albuquerque, N. Mex. The Sandia Corporation, operator of the laboratory, is responsible for the operation and maintenance of all AEC community facilities at Sandia Base. The increase in municipal costs in fiscal year 1958 results from the biennial purchase of organic fertilizer for lawn areas. Greater real estate expenses in the budget year reflects the cost of exterior painting of 152 concrete houses. Increased revenues in fiscal year 1957 and fiscal year 1958 are attributable to increased occupancy of the dormitories.

	Actual, fiscal year 1956	Estimate, fiscal year 1957	Estimate, fiscal year 1958
1. Gross cost:			
(a) Municipal	$77,611	$64,000	$69,000
(b) Utilities	40,213	48,000	41,000
(c) Real estate operations	211,344	203,000	233,000
(d) Equipment			
Total gross costs, Sandia	329,168	315,000	343,000
2. Revenue (budgeted under "Revenues applied"):			
(a) Utilities	66,782	66,000	66,000
(b) Real-estate operations	376,797	388,000	388,000
Total revenue, Sandia	443,579	454,000	454,000
3. Net:			
(a) Municipal	+77,611	+64,000	69,000
(b) Utilities	−26,569	−18,000	−25,000
(c) Real-estate operations	−165,453	−185,000	−155,000
(d) Equipment	0	0	0
Net, Sandia	−114,411	−139,000	−111,000

GRAND JUNCTION

Housing is provided at the Uravan, Naturita, and Monticello processing plants in order to maintain an adequate competent and stable labor force for processing and production operations. Housing is also provided at Slick Rock as an incentive to the miners in the area. At the present time there are 180 housing units involved: 49 at Naturita, 68 at Uravan, 5 at Slick Rock, and 58 at Monticello, including a 10-bed guest house and 30 housing trailers. Twenty houses are

scheduled for construction early in fiscal year 1957 to provide needed housing for key personnel recruited in connection with the Monticello plant expansion, thereby making a total of 200 housing units.

Lower operating costs in fiscal year 1958 result from completion of: (1) repairs of the Slick Rock, Uravan, and Naturita housing and (2) initial rehabilitation of the Monticello trailers. Revenues from community operations are expected to exceed costs by $16,000 in fiscal year 1958.

Real-estate operations	Actual, fiscal year 1956	Estimate, fiscal year 1957	Estimate, fiscal year 1958
1. Gross cost	$90,783	$96,000	$81,000
2. Revenue	63,259	95,000	97,000
3. Net	27,524	1,000	+16,000

COMMUNITY DISPOSAL

Mr. CANNON. What progress have you made in the disposition of community assets?

Mr. FIELDS. Mr. Chairman, I think we have made very good progress. At Oak Ridge, up to July 1, 1957, there have been 3,960 single and duplex houses sold at a price of $14,359,289. These have been sold by the Housing and Home Finance Agency which is the agency charged by Executive Order 10657 with responsibility for the conduct of the sale.

In addition there was a group of commercial properties offered for sale on June 21 and three of these sales have been completed.

At Richland, in view of the fact that a determination of feasibility was delayed beyond that at Oak Ridge, there has not been that same progress. However, the first group of 203 single-family houses was offered for sale to occupants on June 12, and a second group of 165 was offered for sale on July 2, a total of 404. As of July 31, 102 of these had been sold.

Mr. CANNON. That is 50 percent?

Mr. FIELDS. No, sir, that is about 25 percent of the total offered, but that took place within a very short period of time after the offer. There are a great many more to be offered for sale in Richland.

On July 1 the community telephone system at Richland was sold to the General Telephone Co. of the Northwest at a price of $1,965,000. That approximates the appraised value of $2 million, and exceeds the depreciated book value, which was $1,822,000.

So we have made progress, Mr. Chairman, on the disposal of the housing and facilities in these communities. There is some distance to go, however, and we estimate that it will be fiscal 1959 or 1960 before all the housing is disposed of.

DISPOSAL OF UTILITIES

Mr. CANNON. What plans have you for disposing of the utilities?

Mr. FIELDS. The disposal of the utilities will be dependent upon the incorporation of the communities at which time the utilities would then be turned over to the municipality organizations. We will continue to operate them until such time as they can be turned over to

municipal administration. We do not anticipate that this will occur before fiscal 1960.

Mr. CANNON. It was not necessary to wait for incorporation for disposal of the telephone facilities?

Mr. FIELDS. No, sir. The Community Disposal Act provided that these facilities could be disposed of to either private operators or to the municipality.

EFFECT ON BUDGET OF DISPOSAL OF COMMUNITIES

Mr. CANNON. Will there be an annual gain or loss in your community program as a result of the disposal of these two communities, Richland and Oak Ridge?

Mr. FIELDS. Mr. Chairman, there will be an annual cost to us in our appropriation. The Community Disposal Act, provides for assistance payments for a period of 10 years after the properties are disposed of. Heretofore, by reason of collecting rents and charges for utilities, we have operated with a net revenue accruing to the Government for the last 3 or 4 years. With the disposal of the property and no longer collecting rents, we will necessarily find that our revenues are less than our costs so long as we are operating the municipal facilities of the towns. Our estimate of the net cost to the Government will be in the neighborhood of $2 million at Oak Ridge and about a million at Richland until such time as they are incorporated, operating and have developed adequate revenues for the operation of the towns.

INCORPORATION OF COMMUNITIES

Mr. CANNON. It is to the interest of the Government to secure incorporation as early as possible.

Mr. FIELDS. It is.

Mr. CANNON. What about the average householder who has bought the property which he formerly rented from the Government? Is it to his interest or contrary to his interest, financial interest, to secure early incorporation?

Mr. FIELDS. I don't believe there is any great difference to him.

Mr. CANNON. The expenses for utilities will be practically the same?

Mr. FIELDS. Yes.

Mr. CANNON. The service afforded him will be practically the same?

Mr. FIELDS. Yes, sir, it should be practically the same.

Mr. CANNON. So it seems that there is no special interest on the part of anybody there except the Government. Is there any likelihood of early incorporation of these two communities?

Mr. FIELDS. We do not foresee incorporation in the fiscal year 1958. It might occur late in fiscal 1959. The likelihood is that it will be in the fiscal year 1960. Mr. Towne is in charge of our community operations and he concurs in that statement.

Mr. CANNON. What is the occasion for the delay? Is it due to the completion of sales?

Mr. FIELDS. No, sir. It is a matter of developing the method of incorporation. In other words, they have to decide whether they are going to have a city manager form of government or operate by coun-

cils. Studies are going on in each of the communities. The town councils are looking at this matter and are developing the method of incorporation which they wish to follow. Actually the two town councils of Richmand and Oak Ridge have had joint meetings where they have discussed common problems. I think it is more the complexity of the problem than any real unwillingness to move ahead, sir.

OPERATING LOSSES

Mr. CANNON. Your gain here for the actual fiscal year 1956 is $1,692,338, and for 1957, $563,000. But in 1958, it turns in the other direction, $1,636,000. How do you account for this marked reversal?

Mr. FIELDS. You are speaking to the last item which is a net operating cost.

Mr. CANNON. This is on page 165.

Mr. FIELDS. The gross costs, Mr. Chairman, go down, as you may note, but our revenues decrease even more because as the real estate is sold, we no longer collect rent from the housing we were operating, particularly at Oak Ridge, during this period. You will also note that there is a decrease in revenue at Richland. We estimate that the sale of property in these two communities will result in a return to the Treasury of approximately $60 million.

Mr. CANNON. That is covered into the Treasury?

Mr. FIELDS. Yes, sir. But in so doing, we no longer receive the rent from the properties, be it housing or municipal facilities, so the revenue goes down and that is the principal reason for the decrease in revenues.

INVESTMENT IN COMMUNITIES

Mr. CANNON. What was the original investment there?

Mr. FIELDS. May I ask Mr. Towne to supply that to you?

Mr. CANNON. Yes.

Mr. TOWNE. The cost, less depreciation, of all of our real estate that will be sold under the Community Act in both communities combined is $81,700,000. The appraised value of that property as determined by the FHA was about $80,881,000. The proceeds of sale are estimated, on the basis of the experience at Oak Ridge, at around $60 million.

The reason for the reduction in the proceeds below the appraised value is because the Atomic Energy Community Act under which this real estate is sold, provides that the occupants of the houses and others who have priority because they are project-connected people, can take the advantage of certain discounts below fair market value which the law permits them to take. This accounts for the reduction in the amount of actual sales below the appraised values.

Mr. CANNON. Your recovery from your telephone sale was fairly satisfactory. You came very close to getting your full amount there.

Mr. TOWNE. Yes, sir.

HOSPITAL OPERATIONS

Mr. CHAIRMAN. But the operation of your other facilities has not been so satisfactory. For instance, the Oak Ridge Hospital, with

a total operating cost of $1,240,000, is expected to operate at a loss or gain? Will it be self-supporting?

Mr. TOWNE. No, sir, that is a loss.

Mr. CANNON. A loss of how much?

Mr. TOWNE. Our hospital operations at Oak Ridge and Richland have required an operating subsidy from the very beginning and will continue to do so at Richland. At Oak Ridge however, we are authorized and have the appropriation with which to build a new hospital. It is intended as soon as that new facility is built that no continuing subsidy will be required.

Mr. CANNON. At Los Alamos the loss seems to be excessive. How do you account for the difference in the maintenance of the 2 hospitals, 1 at Oak Ridge and the 1 at Los Alamos?

Mr. FIELDS. The hospital at Los Alamos is in a smaller community. It was built in connection with certain facilities that are there and because it is in a town that has no other medical facilities in it. It is located at some distance from other cities. When it was built there was a concern that evacuation, if it became necessary, would not be feasible at Los Alamos because there might have been exposure of personnel to radiation in that laboratory which would require hospitalization of a fair number of them at one time. So the hospital was really designed for other purposes than those of a normal hospital. We have never been able to operate it without a subsidy.

General STARBIRD. This is correct, Mr. Chairman. The cost of operating the hospital is $679,000 for fiscal year 1958 whereas the revenue is estimated at $459,000, or a subsidy of about $220,000. The rates of hospitalization are set by a canvass of the adjacent areas. If those rates were raised, we believe that the persons now routinely using the hospital will go elsewhere for their hospitalization. The effect then would be to decrease the income, rather than increase the income. We have had this hospital studied. The last study was about a year and a half ago. As a result of that study, certain decreases in the scale of operation were made. However, as Mr. Fields brought out, the hospital must have such a capacity and ability as to be able to take care of any serious accidents, if they occurred.

Mr. CANNON. In view of the fact that facilities are available elsewhere, and you say they would go to those facilities and the costs would increase, what would be the effect of discontinuing this hospital?

General STARBIRD. The facilities elsewhere, sir, are those about 35 miles away. The nearest one is in Santa Fe. Those in Albuquerque are over a hundred miles away. For routine treatment, individuals can make arrangements to go to the other hospitals. However, if you have an accident, industrial or atomic, you would not want to go those distances to a hospital. Though I have not personally checked it, if there were a serious accident probably these adjacent hospitals would not be immediately staffed and available to take it.

FINANCIAL IMPLICATIONS OF DISPOSAL

Mr. CANNON. The whole matter resolves itself, then, into a summary to the effect that the change has been disastrous to the Government. We have lost much more by insisting on the sale of the

communities and facilities than we would have lost had we retained possession of them?

Mr. FIELDS. Mr. Chairman, we are not disposing of the community at Los Alamos. That remains as a Government-operated community. It is the two communities of Oak Ridge and Richland that are being disposed of.

Mr. CANNON. They are all affected by the same conditions, both at Richland and Oak Ridge and Los Alamos. The effect is practically the same at all of them, that is, the effect of Government disposition or proposed Government disposition.

Mr. FIELDS. Yes, sir.

Mr. CANNON. The disposal has been much more expensive and has cost the Government a great deal more than had we retained it in the original status and we held title to all the residences.

Mr. FIELDS. We were operating with a net revenue of a small amount on these 3 communities so that there was no operating cost to the Government for the operation of these 3 communities. However, there was the capital investment on which there was no return being made, namely the $80 million that was invested in those facilities. There was no charge for that computed in the net revenue figures that we have used here.

Mr. CANNON. In computing profit and loss, did you not take into consideration original capital or depreciation or did you take into consideration depreciation?

Mr. FIELDS. We did not take into consideration either of these, sir. Our operating budget did not take those into account.

Mr. CANNON. When you take into consideration the original investment, it was being constantly operated at a loss, is that correct?

Mr. FIELDS. Yes, sir, that is correct, by including the amount of depreciation.

Mr. CANNON. What would you compute the average annual loss when you take into consideration the original investment?

Mr. TOWNE. This is a difficult question to answer, Mr. Chairman, because you have to make so many assumptions as to what the appropriate tax burden would be on the property that we were owning and operating. We have been performing two functions in these communities, and I suppose it would be better if we had two budgets, one that of a real estate operator, and the other that of a city government. If you assume that as a real estate operator we were paying ourselves the equivalent of a tax sufficient to defray all of the expenses of government, rather than a tax equivalent to that prevailing in the local communities—we have not figured this out in detail—we probably would have shown a loss after taking a reserve for depreciation or amortization of our investment. If on the other hand you assume that we were to pay only the equivalent of a prevailing rate in taxes, then it appears that at Oak Ridge we would have probably been able to amortize our investment over a period of twenty-odd years, and likewise at Richland. I would hesitate to say whether we would have made any net return after payment of taxes and amortization. This becomes a question for considerable speculation.

Mr. CANNON. The instant the title passes, taxes come into operation.

Mr. TOWNE. The AEC charges the equivalent of a tax, and the law under which the property is disposed of stipulates that we must charge no more than that prevailing in surrounding communities. At Oak Ridge we have taken the cities of Knoxville and Morristown as the basis for determining the rate. At Richland, Pasco, and Kennewick are the nearby communities.

Mr. CANNON. Both Oak Ridge and Richland would, in the course of twenty-odd years, have been amortized?

Mr. TOWNE. Provided you assume that the real estate paid a tax comparable to that paid in surrounding communities.

Mr. CANNON. Would that be a fair assumption?

Mr. TOWNE. This would not have been enough to defray the actual costs of municipal services. This is the dilemma that both communities face, now and in the future.

Mr. CANNON. That is a problem in any community, I suppose.

Mr. TOWNE. It is exaggerated to some extent in these communities for this reason, Mr. Chairman. The per capita tax base available to the residents upon incorporation and on which we secure tax-equivalent revenues is very low as contrasted with that prevailing in a normal town that has grown up and accumulated the usual industrial tax base. At Oak Ridge, the tax base per capita is only about half as high as it is in Knoxville, the nearest large city. Therefore, you have a penalty upon the residents due to the failure of the community to produce the type of tax base that they would normally expect to have.

Mr. CANNON. Are there any further questions on this item?

Mr. JENSEN. Yes; I would like to ask some.

Mr. CANNON. Mr. Jensen.

SALE OF UTILITIES

Mr. JENSEN. You are proposing not only to sell the homes and vacant lots within the area that is to be incorporated when this property is to be sold, but you also must dispose of, I presume, the lights, water, sewer, sidewalks, telephone facilities, the schools, and the hospitals. Just what do you expect to receive in revenue from the sale of those facilities?

Mr. FIELDS. Mr. Jensen, the law has certain specific provisions with respect to these facilities. I would like Mr. Towne to review those, if you wish, sir.

Mr. JENSEN. Very well.

Mr. TOWNE. The Community Act provides that, in the event the residents incorporate and take over the functions of local government, they shall be given without charge the utilities and the municipal installations which would permit them to take over the functions of government, and then operate them out of the revenues that they collect from the sale of utilities and out of the taxpayments that they get from private-property owners. In addition to that, the statute provides that AEC shall make annual assistance payments to local government for a period up to 10 years in the event that such payments appear to be necessary to retain the standards of service that are required.

Mr. JENSEN. That means, in effect, that, even after all those facilities and utilities are given to these municipalities, free, gratis, then, if the record shows any time during 10 years that the municipality needs further subsidy to meet its expenses, that the Federal Government shall assist them?

Mr. TOWNE. That is correct, sir. This goes back to the problem that I mentioned earlier. When the residents take over, they will take over a tax base which is woefully defective, notably at Oak Ridge. It is only about half as valuable per capita as at Knoxville. Another way of putting it is that the industrial installations which the AEC operates in the adjacent communities are not included in the tax base. They are tax free.

Mr. FIELDS. Mr. Jensen, this Community Disposal Act was passed by Congress basically with the purpose of making these normal communities, but the act recognized also that there was a continuing need on the part of the Government for their operation for a long time, and with no curtailment of our activities in the major production facilities at those two locations. We need to continue to operate those plants. We will, for a long time. We don't foresee any falling off of the employment or population in those communities. It was an attempt to make these normal operating communities, to carry on the responsibilities of the normal citizen in a town, with a recognition at the same time that it had to be done in a manner which would assure that the employees were encouraged to remain there and work at these plants.

So, it is quite a bit different from the disposal of something that we have no need for.

STATUS OF INDUSTRY IN AEC COMMUNITIES

Mr. JENSEN. Is there a prohibition under law to keep any other industry out of the incorporated towns?

Mr. FIELDS. No.

Mr. JENSEN. There is not?

Mr. FIELDS. Not in the communities of Oak Ridge and Richland.

Mr. JENSEN. Are there any other factories in operation now?

Mr. TOWNE. There is a very small industrial activity in Oak Ridge. There is hardly any in Richland except the usual service activities, such as lumberyards and the like that serve the community. For example, we have the Abbott Laboratories at Oak Rdige, which package isotopes and sell them.

Mr. JENSEN. Is that a private concern?

Mr. FIELDS. Yes.

Mr. JENSEN. It is taxable?

Mr. FIELDS. Yes; it would be taxable.

Mr. JENSEN. I believe you said the Federal Government had about $80 million invested in these 2 areas.

Mr. TOWNE. That is currently the book value less depreciation.

Mr. JENSEN. After these towns have been incorporated and the property has been sold to private individuals, that property will then go on the tax rolls of the respective towns?

Mr. TOWNE. That is right.

Mr. JENSEN. The Federal Government will get very little, if any, revenue, except from withholding taxes from the employees.

Mr. TOWNE. No, sir. We charge private-property owners, as soon as they have bought our property, the equivalent of a tax—a real-property tax—just as if we were a municipality.

Mr. JENSEN. If the city is incorporated?

Mr. TOWNE. No; before incorporation.

Mr. JENSEN. I understand that.

Mr. TOWNE. After incorporation, the city has the taxing authority. We no longer have it. They take it over.

Mr. JENSEN. That is correct. Both the city and the county in which the city is located will derive the benefits from the tax revenues, but the Federal Government will derive no benefit from property tax.

Mr. TOWNE. At that time, the Atomic Energy Commission will be in the same position as that of a large industry adjacent to a normal community. That is the position we will be in.

Mr. JENSEN. But the Government-owned facilities are not taxable.

Mr. TOWNE. That is correct. We will no longer have any responsibilities or any identity as a taxing entity in the area.

COST OF COMMUNITY OPERATION

Mr. JENSEN. I want it completely understood that I am not opposed to the disposal of these properties, because no doubt, over the long pull the Federal Government will benefit from the sale of that property rather than to continue losing money each year. What do you estimate now that the Federal Government is losing in being required to pay for the operation and upkeep of these communities, including depreciation? Have you an estimate on that?

Mr. TOWNE. You mean the property that is now being sold?

Mr. JENSEN. The property that you now own. Do you have an operating loss? Do you have a depreciation loss? Do you have an upkeep loss? Even though you don't pay any tax into the Federal Government, you still have an overall loss; have you not?

Mr. TOWNE. I believe there is an operating surplus on real estate for all communities combined. This will show up on the tables you have before you, one for each community. What it does not show is the deduction from that that will have to be made for two purposes. One, to reflect the equivalent of a tax that might be paid to ourselves as a municipality, and the other the amount that would have to be paid to amortizing the investment.

Mr. JENSEN. I understand that. That is another matter. You also do not pay any interest on the money that the Federal Government has expended in those areas.

Mr. TOWNE. That is right.

Mr. JENSEN. That is quite an item in itself. Over a period of about 30 years at 2½ percent interest, it would amount to as much as the original total cost of the project of $80 million. Regardless of what can be said, when the Federal Government has $80 million invested, that means it is costing us about $80 million every 30 years just in interest. That is another reason why I am not opposed to disposal of these properties. At least we will get some of the money out of it.

What do you expect will be the final amount of money that will be realized from the sale of this property?

Mr. FIELDS. We estimate approximately $60 million would be the proceeds of the sales.

Mr. TOWNE. This has to be a very approximate estimate.

Mr. JENSEN. And that $60 million will be covered into the Treasury of the United States?

Mr. FIELDS. That is true.

Mr. JENSEN. On $60 million over a period of 30 years at 2½ percent interest, that would amount to more than $60 million.

Mr. FIELDS. Yes, sir.

Mr. JENSEN. So over a period of 25 or 30 years the Federal Government would save $60 million.

Mr. STRAUSS. It was 2 percent money when the money was invested. It is 4 percent money perhaps now.

Mr. JENSEN. I know that. I just took the 2½ percent out of the air as an example. Right now, of course, it would be much more. From the standpoint of good business, even though we give these utilities away free gratis, which looks a little out of reason to me—I thought we should at least get a little out of the utilities—we are not losing too much. We have the same problem in Coulee City which was built during the construction of Grand Coulee Dam. The bill was on the Consent Calendar the other day to dispose of that city to private owners and give all these utilities way. About 2 weeks ago I had asked the Department of the Interior to give me in black and white just exactly what they propose to do regarding the sale of that property. The bill came on the Consent Calendar on the floor last week. I asked that the bill go over without prejudice at least until I could get this information that I had asked for. They did that. Then the Department of Interior high officials called me and asked me why I did it, and I said I asked you for information in black and white regarding this matter and I have not received it. I think I am entitled to know, as a Member of Congress, and especially a member of the Appropriations Committee that deals with Interior Department matters. They promised me now they would get it for me and hoped I would not object when the bill comes up on the floor again.

That is why I am going into all of this questioning today. Of course, we did pass this bill and it is the law that we contribute all these facilities under such a proposition. But we are mighty liberal with the people's money. Over the long pull no doubt it will save the taxpayers money to dispose of this property. That is all, Mr. Chairman.

Mr. RABAUT. As I see this situation, it is a little different from an individual municipality. In the first place, the industry is not connected to the municipality, although it is in the municipality. Am I right in that?

Mr. STRAUSS. The municipality came into existence as a result of the industry.

Mr. RABAUT. Most municipalities would have the benefit of the taxation upon the industry which is not the case in this situation. Accordingly, there is a big difference there in the returns from taxes.

Mr. JENSEN. I understand that.

Mr. RABAUT. When the sale price was considered for these individual properties within the municipality, it must have been a part of the contract that you could put a tax upon them while in the present status and until the property is turned over to a municipal government.

Mr. TOWNE. There is a provision in the deed.

CONSIDERATION OF STATE OF UTILITIES IN APPRAISALS

Mr. RABAUT. That is good. I don't think it is quite fair to compare this area that we are talking about—we will call it a municipality—with adjacent municipalities because of its very nature, having been established recently, so it would have many improvements over other municipalities as far as facilities go. I would say the sewers would be good, the water supply would be excellent, and everything else would be very good there, including the streets and sidewalks.

Mr. STRAUSS. The fire department is much more adequate than would be needed for a town like that, because it had to assist in protecting the plants as well.

Mr. RABAUT. Yes. I would say it would be quite up to date which is very good.

Mr. FIELDS. A good part of these towns was built during the war.

Mr. RABAUT. The original cost less depreciation was $81 million and the FHA appraised it at $80 million and the proceeds of sale will be about $60 million. I hope at the time that the FHA appraised it, they took into account the facilities which accompanied it.

Mr. TOWNE. Yes. I should say the availability of the utility service played a heavy part in the determination of the value of the property.

VACANT PROPERTY

Mr. RABAUT. How much of the area is still vacant? What percentage would you say?

Mr. TOWNE. It varies. In Oak Ridge there is quite a lot of vacant land. There are over a thousand vacant improved lots. There is quite a bit of acreage that could be improved at small additional expense. In Richland within the area intended for incorporation there are only a few hundred lots that are improved, and virtually no vacant land.

Mr. RABAUT. Do the facilities run to the vacant lots?

Mr. TOWNE. In some cases, but not in all.

Mr. RABAUT. That property would be more valuable than the one that did not have the facilities.

Mr. TOWNE. Yes.

Mr. RABAUT. Has there been a value set upon these vacant properties?

Mr. TOWNE. Yes, sir. The value has been set on all of the properties, including not only the vacant lots, but also the commercial property in which we have an interest.

Mr. RABAUT. Is that included in this $60 million suggested selling price?

Mr. TOWNE. That is correct, sir.

Mr. RABAUT. I think the subject is pretty well covered. It is very true, as Mr. Jensen says, that there is no profit to the Government from operating this municipality when you consider interest in the investment and all the other direct and indirect costs. Nevertheless, we have to take into consideration that the protection of the country

was developed in the industry established there which would more than make up for the difference in price.

DISPOSITION OF CHURCHES AND THEATERS

Mr. CANNON. When we visited Oak Ridge in 1945, everything in the city was part of the Government. We were astonished when we went down there, in a city of 60,000 people, in order to operate the project, to learn of all the provisions that had to be made for the labor, housing, and the ordinary community necessities. As I recall it, the churches and theaters belonged to the Government as well as the fire departments and police departments, the transportation system, the power system, sewage and water systems. Incidentally, what disposition has been made of the churches and theaters?

Mr. TOWNE. Mr. Chairman, the first type of property offered for sale in Oak Ridge, and this antedates the date of the passage of the present Atomic Energy Community Act, were church sites. The Commission long ago adopted the policy of selling to church organizations sites at which they could build their own churches. Today there are over 20 churches, some very beautiful ones, built in Oak Ridge, and in Richland there are at least as many, all privately financed on land that is either owned by the church organization or in a few cases leased by them.

With regard to theaters, in some cases they have continued in Government-owned buildings and in other cases some were built by private investors on land leased from the Government. The people who have been leasing our buildings and who have built their own buildings on land leased from the AEC are given the option to purchase the Government's interest in those properties under the Community Act.

BENEFITS DERIVED FROM COMMUNITY OPERATION

Mr. CANNON. The Government in disposing of these facilities, as was, of course, necessary, seems to have been as considerate as possible of those who occupy the property and facilities. Every effort has been made to be fair in the assessments and the prices agreed upon and in the transfer of title of the property. But would you say on the whole when you consider the original investment and the interest and depreciation and the loss which naturally would accompany any disposition of property of this character that it was a high price to pay for the atomic bomb? Or was it too high a price?

Mr. STRAUSS. To whom are you directing that question, sir?

Mr. CANNON. Anyone who will answer it.

Mr. STRAUSS. I would like to answer it, Mr. Chairman, to say that I do not think it is too high a price. Of course, it is only a very small part of the total price.

Mr. CANNON. Yes; and a very small part of the value received. The testimony before the Armed Services Committee was to the effect that the atomic bomb dropped on Hiroshima seved at least half a million American soldiers. If it had been necessary to take Japan as they had to take Okinawa the loss would have run up between 500,000 and a million American boys and untold amounts of money.

So on the whole, as Mr. Strauss very well says, it was not an exorbitant price to pay for the results secured.

Are there any further questions?

LENGTH OF LEASES

Mr. RABAUT. Yes. Of these properties that were leased, such as the theaters which were put on leased land, how long a lease do these people have in those lands? Will that interfere with these regular sales now?

Mr. TOWNE. There is a clause in the lease in each case which protects the lessee in the event he elects not to buy the Government's interest in the property. The leases vary in length from a few years in Government-owned buildings up to as long as 99 years on land on which an individual has built his own building. But in every case, the lessee's interests are protected either by virtue of the fact that he has in effect an option to buy at the appraised value, or in the event he elects not to buy, he can continue to be the lessee, but someone else may buy the Government's interest and will be his new landlord.

Mr. RABAUT. You say on the appraised value; the appraised value as of what date?

Mr. TOWNE. April 1956 was the date on which the appraisal was made.

Mr. RABAUT. Is the return predicated on that value?

Mr. TOWNE. That is right.

ATOMIC WEAPONS A DETERRENT TO WORLD WAR III

Mr. STRAUSS. Mr. Chairman, could I add a footnote to the point which you have tellingly made about the value to the country in the saving of lives and property as a result of the fact that we had the weapon at the end of World War II?

Mr. CANNON. Yes; we would be glad to have it.

Mr. STRAUSS. I think perhaps another value which is very great and which cannot be definitely established is the fact that having these weapons, and having Oak Ridge and Richland and these communities in which they are made, has provided the deterrent thus far to world war three. No one can measure that in terms of savings to the people of the United States or the world.

Mr. CANNON. That is very true. War at best is a very expensive luxury, and there is little return from investments made in war.

But for the Second World War the progress made in aviation would have been impossible. But for the Second World War, in terms of the small salvage saved out of the general wreckage that always accompanies war, the advantage to the future, not yet fully realized, the industrial progress, the development of atomic energy and many similar scientific and economic assets must also be considered in striking a balance.

So, on the whole, the investment has been more than justified. As Mr. Strauss says, the advantages of deterring a third world war and the additional advantage of savings of hundreds of thousands of men, the advantages accruing from the investment cannot be estimated.

Are there any further questions?

VALUE OF APPRAISALS

Mr. TABER. Yes, Mr. Chairman. I notice that the operating costs in this particular item seem to be about the same. At Oak Ridge there was an assessed value of about 18 or 20 million dollars. What was the appraised value of that?

Mr. TOWNE. The appraised value of Oak Ridge—and I presume you are looking at the table on page 171—or rather the assessed value shown here is the same as the appraised value for the purposes of sale. We make no distinction in our figures between assessed and appraised or fair market value.

Mr. TABER. The value seems to have been doubled on those houses and the other property between 1957 and 1958.

Mr. FIELDS. Mr. Taber, those values have not changed. Those tables have to do with our estimate of the properties that will be sold. Since the number that will be sold goes up in fiscal 1958, over what the sales were in fiscal 1957, that accounts for the difference.

Mr. TABER. This is just the expected sales.

Mr. FIELDS. Yes. The appraised values remain the same.

Mr. STRAUSS. It is cumulative. The amount in the 1958 figure also includes the 1957 figure.

SALES OF PROPERTY AT OAK RIDGE AND RICHLAND

Mr. TABER. Will you put in the record the total of sales at each of these places?

Mr. FIELDS. As of what date, sir?

Mr. TABER. For 1957.

Mr. FIELDS. Fiscal year 1957, sir?

Mr. TABER. Yes, sir.

Mr. FIELDS. Yes, sir.

Mr. TABER. Will you please put it all in one place?

Mr. FIELDS. I will do that, sir.

(The information follows:)

Sales of property at Oak Ridge and Richland by Housing and Home Finance Agency, fiscal year 1957

	Appraised value	Sales revenue
1. Oak Ridge, Tenn.	$19,110,610	$14,359,289
2. Richland, Wash.	226,242	182,228
Total	19,336,852	[1] [2] 14,541,517

[1] Does not include direct sale of telephone utility at Richland, Wash., by AEC to General Telephone Co. for $1,965,700.

[2] Difference between sales revenue and appraised value represents discounts allowed to purchasers of property in accordance with Public Law 221, 84th Cong.

Mr. FIELDS. When we opened, you will recall I mentioned that sales at Oak Ridge of single and duplex houses were $14,359,000 during the fiscal year. There was also the sale of the telephone system at Richland in the amount of $1,965,000.

APPRAISED VALUE OF PROPERTY UNSOLD

Mr. TABER. You also might give me the appraised value of the property that remains unsold that you hope to sell.

Mr. FIELDS. Yes, sir.

(The information follows:)

Appraised value of property remaining to be sold by Housing and Home Finance Agency as of June 30, 1957 [1]

	Oak Ridge, Tenn.	Richland, Wash.	Total
Appraised value of property to be sold by HHFA	$31,982,809	[1] $48,898,650	$80,881,459
Property sold, fiscal year 1957 (at appraised value)	19,110,610	226,242	19,336,852
Remaining to be sold, June 30, 1957	12,872,199	48,672,408	61,544,607

[1] Schedule includes housing units, apartments, vacant land, commercial properties, and other community property to be disposed of by HHFA. Schedule does not include value of municipal properties, schools, hospitals, and utilities to be donated by AEC to the municipalities or other eligible recipients.

Mr. CANNON. Are there any further questions?

Mr. KIRWAN. No, Mr. Chairman.

Mr. JENSEN. Mr. Chairman, I would like to ask one question.

Mr. CANNON. Mr. Jensen.

Mr. JENSEN. Admiral Strauss, did the Atomic Energy Commission feel satisfied with the appraisal figures which the FHA decided on as to the value of these properties?

Mr. STRAUSS. We heard from our staff no complaints with the appraisal.

Mr. JENSEN. That is, the Atomic Energy Commission officials who are in charge of such procedures.

Mr. STRAUSS. That is so. Our people in Washington and our people on the site. The Commissioners, as a group of men, had no independent opinion of their own on a technical matter of that sort.

Mr. JENSEN. Thank you.

TERMS OF SALE OF PROPERTY

Mr. TABER. I wonder if you can tell us on what terms these sales are made? That is, whether they are made on so much down or what the percentages are.

Mr. TOWNE. Mr. Taber, the Community Act specifies that the property shall be sold on the basis of financial arrangements normally available in the real-estate market. In the event that private financing on reasonable terms and conditions is not available, then the Government is permitted to take back the mortgages on terms and conditions that are deemed by it to be reasonable. To date, most of the properties have been sold on about the same terms and conditions that would be

available to a party getting an FHA-insured mortgage, which means about 10 percent down and the balance over 20 or 25 years at the prevailing rate of interest.

Program Direction and Administration

Mr. Cannon. Are there any further questions? If not, let us turn to "Program direction and administration." We will insert the pages beginning at page 186 through 200 into the record at this point.

(The matter referred to follows:)

Program Direction and Administration, Operating Costs

Program statement

Estimate, fiscal year 1958	$44,614,000
Estimate, fiscal year 1957	38,298,000
Increase	6,316,000

The general direction of the Commission's programs is handled by Commission employees budgeted under "Program direction and administration." The employees budgeted under this program are responsible for (1) arranging for the work to be accomplished and negotiating production, research, construction, and related contracts; (2) maintaining necessary liaison with the contractors to assure protection of the Government's interest in contract performance; (3) developing standards and control measures for internal security and protection of Government funds and property; (4) encouraging private civilian applications of atomic energy and granting licenses for peaceful uses of atomic energy; (5) conducting a program of cooperation with other nations; and (6) providing normal administrative services required within the agency.

"Program direction and administration" activities are conducted through the Washington headquarters and 10 operations offices and their subordinate area offices. The costs of "Program direction and administration" include the costs of personal services, travel, supporting costs for office operation and maintenance, certain activities conducted directly by the Commission, and in fiscal year 1958, for the first time, contributions to the civil service retirement fund.

The estimated requirements for both fiscal year 1957 and fiscal year 1958 reflect a continuing growth occasioned by the continued all-out effort in weapons development and production, the accelerated development of civilian and military reactors, the growing interest of non-Government groups in the civilian applications of atomic energy, and the impact of international cooperation activities.

Summary of estimates, by category

Category	Actual, fiscal year 1956	Estimate, fiscal year 1957	Estimate, fiscal year 1958
1. Personal services	$27,417,625	$30,465,000	$32,607,000
2. Travel	1,706,124	2,010,000	2,528,000
3. Other objects	5,835,016	5,424,000	8,987,000
4. Equipment not included in construction projects	354,160	399,000	492,000
Total, "Program direction and administration"	35,312,925	38,298,000	44,614,000

JUSTIFICATION OF CATEGORIES

1. Personal services, $32,607,000

This budget provides for an average permanent staff of 4,746 full-time AEC employees in fiscal year 1958, plus a small number of professional and scientific

consultants whose services are utilized for limited periods. A breakdown of total costs follows:

	Fiscal year 1957	Fiscal year 1958
(a) Net cost of permanent employees, including terminal leave costs	$29,800,000	$31,789,000
(b) Costs of other employees	267,000	270,000
(c) Regular pay in excess of 52-week base	0	121,000
(d) Payment above basic rates	390,000	419,000
(e) Reimbursements to other agencies	8,000	8,000
Total personal services	30,465,000	32,607,000

(a) Net cost of permanent employees, including terminal leave costs, $31,789,000.—The estimates provide for employment at the beginning and end of the fiscal year as follows:

	Fiscal year 1957	Fiscal year 1958
Starting employment	4,347	4,638
Ending employment	4,638	4,816

Computation of the dollar estimates:

	Fiscal year 1957	Fiscal year 1958
(1) Average employment	4,512	4,746
(2) Plus man-year equivalent for terminal leave payments	34	34
(3) Total permanent man-years	4,546	4,780
(4) Average man-year cost	$6,555	$6,650
(5) Net cost of permanent employees, including terminal leave costs (line (3) multiplied by line (4))	$29,800,000	$31,789,000

The estimates are based on progressive recruitment in both years principally to meet requirements of accelerated civilian and military reactor programs, certain expansions in weapons activities, and the impact of the growing programs of civilian application and international cooperation.

The man-year equivalent for terminal leave payments for persons who draw terminal leave payments on separation from Government employment is based on experience of prior years.

The average man-year cost reflects an increase of $95 in fiscal year 1958, which is attributable chiefly to automatic in-grade advancements, and the employment of personnel at a higher than average salary rate such as license inspectors, AEC foreign scientific representatives, and other scientific and technical personnel.

The distribution of permanent civilian employment under "Program direction and administration" by office follows:

Office	Actual, June 30, 1956	Estimated, June 30, 1957	Estimated, June 30, 1958
Grand Junction	158	162	162
Hanford	263	258	258
Oak Ridge	727	729	730
Savannah River	234	239	243
Albuquerque	726	718	752
San Francisco	122	154	177
Chicago	320	339	387
Idaho	109	131	142
Schenectady	82	99	129
New York	146	166	196
Subtotal, field offices	2,887	2,995	3,173
Washington headquarters and extensions	1,460	1,643	1,643
Grand total, permanent civilian employment	4,347	4,638	4,816

The primary reasons for changes in strength of individual offices during 1958 are as follows:

Oak Ridge (+1): This small increase is a combination of: reductions possible due chiefly to completion of major construction; increases in operating program divisions mostly for supervising expanded plant operation and reactor and research activities and for industrial participation functions; and increases for compliance inspections of licensees.

Savannah River (+4): Civilian application functions, patent activities, and compliance inspections of licensees account for this small increase.

Albuquerque (+34): These additional employees will be required because of expansion of programs both in size and complexity, and for compliance inspections of licensees.

San Francisco (+23): Additional personnel will be required in Technical Operations Division, Security Division, Administrative Services, and Finance Division, due to the overall increased workload at this office, including the industrial participation program, and for compliance inspections of licensees.

Chicago (+48): Increases are required throughout the Chicago operations office proper, Lockland area office and Pittsburgh area office, due to the continued expansion of civilian and military reactor activities, and procurement of special reactor materials. Additions will be required in the Chicago operations office also for compliance inspections of licensees.

Idaho (+11): This requirement stems chiefly from expanded operations at the National Reactor Testing Station and the construction programs handled by this office. One employee will be required for compliance inspections of licensees.

Schenectady (+30): This increase is distributed throughout the operations office and is primarily related to the more complex nature of operations under multiple contractors, which involves construction programs and assignment of additional research and development projects. Personnel are required also for compliance inspections of licensees.

New York (+27): This increase represents requirements of personnel for compliance inspections of licensees, and general increases required to administer effectively the research and development and construction programs under this office which are increasing in volume and complexity.

(*b*) *Costs of other employees, $270,000.*—These costs represent payments to part-time and w. a. e. employees, such as the General Advisory Committee, the Patent Compensation Board, members of other boards, committees and panels, and other consultants and experts who are paid only when employed.

(*c*) *Regular pay in excess of 52-week base, $121,000.*—Compensation for permanent employees involving pay for extra days of pay in excess of 260 days of pay in one fiscal year. One extra day of pay is involved in fiscal year 1958.

(*d*) *Payment above basic rates, $419,000.*—This provides for scheduled and emergency overtime, night work differential, and living and quarters allowance for AEC employees stationed overseas. A slight increase is budgeted for fiscal year 1958, due principally to increase in the number of personnel to be stationed overseas.

(*e*) *Reimbursements to other agencies, $8,000.*—This provides chiefly for reimbursement to the Department of State for furnishing secretarial services to the Johannesburg, South Africa, Office and to the Civil Service Commission for furnishing testing services to the Albuquerque Operations Office.

2. Travel, $2,528,000

This estimate covers the cost of domestic and foreign travel of program direction and administration permanent and part-time personnel in the performance of their assigned functions. A comparison of estimates for fiscal year 1957 and fiscal year 1958 for field offices and the Washington headquarters and extensions follows:

	Fiscal year 1957	Fiscal year 1958
Field offices	$1,090,000	$1,290,000
Washington headquarters and extensions	920,000	1,238,000
Total	2,010,000	2,528,000

The primary increases for travel costs in fiscal year 1958 are:

Field offices

The travel estimate for field offices for fiscal year 1958 represents an increase of $200,000 above the fiscal year 1957 level. The increase breaks down as follows:

(1) *Conduct of compliance inspections of certain licensees, $140,000.*—Responsibility for conducting inspections of licensees holding byproduct and source material licenses granted by the Commission under the Atomic Energy Act of 1954 is being delegated to managers of operations. It is estimated that the number of licenses requiring inspection will exceed 3,000 in fiscal year 1958, requiring the services of 35 to 40 inspectors. The objectives of the inspection program are three-fold:

(a) Gathering of factual data to determine if the licensee or permit holder is in compliance with Commission regulations.

(b) Gathering information which will assist the Commission in determining whether rules, regulations, policies, and licensing practices of the Commission are effective and adequate.

(c) To establish cordial, effective, and close relationships with State and other organiaztions on inspection matters.

(2) *Increase in administrative and supervisory travel.*—The increase in administrative and supervisory travel in fiscal year 1958 is directly proportional to the increased average employment requested for field offices. The largest increase requested for a single office is $17,000; no increase is requested for three offices. The major factors necessitating increased travel costs in fiscal year 1958 are—

(a) Increased numbers of raw materials processing plants on the Colorado Plateau involving travel by personnal of the Grand Junction Operations Office.

(b) Necessity for more travel of personnel of the Albuquerque Operations Office in connection with increased utilization of the Nevada test site and liaison with contractors for the expanded weapons program.

(c) Additional travel requirements associated with the overall increased activities under the San Francisco Operations Office, for which an increase in average employment of almost 20 percent over fiscal year 1957 is requested in this budget.

(d) The accelerated reactor development program and contracts for production of special reactor materials will necessitate a greater level of travel in the Chicago Operations Office.

(e) The Idaho Operations Office will require increased travel in connection with the construction programs administered at the National Reactor Testing Station.

(f) An expanded research and development program involving an increasing number of projects and contractors will necessitate more travel by personnel of Schenectady operations office. The higher level of travel is directly related to the requested increase of 25 percent in employment over fiscal year 1957.

(g) An increase in employment over fiscal year 1957 is being requested for the New York operations office for an expanding construction program in scattered locations and closer liaison on the large number of research and development contracts administered by that office. These situations will require a higher level of administrative travel in fiscal year 1958.

Washington headquarters and extensions

The travel estimate for Washington headquarters and extension provides for an increase of $318,000 above the fiscal year 1957 level. The requested increase breaks down as follows:

(1) *Additional funds for full year's travel requirements for personnel added in fiscal year 1957, $46,000.*

(2) *Travel in connection with international scientific and technical conferences, $72,000.*—Included in this item are travel required for (*a*) planning and coordinating the United States participation in the planned Second International Conference on the Peaceful Uses of Atomic Energy, (*b*) assistance and coordination in the preparation of a suitable peaceful uses exhibit for the Brussels World Fair in 1958, (*c*) support and assistance in conducting planned international topical, technical, and scientific conferences on the more specialized

aspects of atomic energy, (*d*) planning and participation in regional atomic energy conferences, and (*e*) United Nations conferences, including special committee work.

(*3*) *Travel required for "Atoms for Peace" program, $80,000.*—This item covers travel in connection with bilateral agreements for cooperation. These agreements require extensive travel both prior to and after agreements are executed. Increasing international interest in developing peaceful uses of atomic energy should result in additional requests for bilateral agreements and also necessitates close liaison between the United States and agreement countries. Extensive foreign travel will be required on an increasing scale in both fiscal year 1957 and fiscal year 1958, particularly on the part of the staff of the Divisions of International Affairs, Reactor Development, Biology and Medicine, and Research for on-the-spot inspections, consultations with officials, and rendering scientific, technical, and engineering assistance in areas covered by agreements.

(4) *Travel related to activities and operation of AEC foreign offices, $65,000.*—This estimate provides for travel in connection with activation of additional AEC foreign offices during fiscal year 1958, "at post" travel for all foreign offices to be in operation in fiscal year 1958, travel of personnel of foreign offices to the United States for consultation, and supervisory visits to foreign offices.

(5) *Travel related to industrial participation activities, $29,000.*—The growing program of industrial participation will require additional travel for the following purposes: Attendance of legal staff at conferences with State and local authorities and license applicants; travel of staff of Division of Civilian Application in connection with hazards evaluation, conferences with access permit holders and public authorities, discussions at operations offices relative to the development and administration of policies with respect to industrial participation; travel in carrying out the information phases of the industrial participation program; prelicense visits by radiological safety personnel to an increasing number of applicants for byproduct material licenses; and travel of staff of the Division of Nuclear Materials Management relative to allocation and accounting for source and special nuclear materials.

(6) *Miscellaneous other increases, $26,000.*—This item includes orientation travel of a larger group of trainees in the junior management development program, travel of representatives to an international declassification conference, additional travel required for on-site classification reviews and appraisal of classification practices in field offices, and additional travel for compliance inspections of licensees by Washington staff.

The estimated travel costs by office for fiscal year 1957 and fiscal year 1958 are set forth below:

	Fiscal year 1957		Fiscal year 1958	
	Days of travel	Cost	Days of travel	Cost
Grand Junction	4,295	$88,000	4,458	$93,000
Hanford	1,179	46,000	1,269	50,000
Oak Ridge	5,357	150,000	5,679	159,000
Savannah River	1,939	64,000	2,212	73,000
Albuquerque	14,671	370,000	15,489	399,000
San Francisco	1,351	50,000	1,811	67,000
Chicago	4,663	160,000	6,078	207,000
Idaho	1,411	79,000	1,754	91,000
Schenectady	1,406	45,000	1,906	70,000
New York	1,672	38,000	3,564	81,000
Subtotal, field offices	37,944	1,090,000	44,220	1,290,000
Washington headquarters and extensions	23,618	920,000	30,973	1,238,000
Grand total, travel	61,562	2,010,000	75,193	2,528,000

3. Other objects, $8,987,000

This estimate covers the cost to AEC for (1) transportation of things, communications, rents, utilities, supplies, maintenance, and contractual services at the Washington headquarters and all field locations, and (2) agency contributions to civil-service retirement and insurance funds.

A comparison of estimates for fiscal year 1957 and fiscal year 1958 for field offices and Washington headquarters and extensions follows:

	Fiscal year 1957	Fiscal year 1958
Field offices	$3,391,000	$4,904,000
Washington headquarters and extensions	2,033,000	4,083,000
Total	5,424,000	8,987,000

Field offices:

The increase of $1,513,000 requested for field offices breaks down as follows:

(*1*) *Contribution to civil service retirement fund, $1,255,000.*—The Civil Service Retirement Act amendments of 1956 (Public Law 854, 84th Cong.) provide that from and after the first day of the first pay period which begins after June 30, 1957, each agency shall contribute to the retirement fund a sum equal to the retirement deductions from employees' salaries. The contribution to be costed to program direction and administration in field offices in fiscal year 1958 has been computed at $1,255,000.

(*2*) *Other increases, $258,000.*—This increase is to support the increased employment requested in fiscal year 1958 for field offices, and to meet a few isolated special situations involving small increases over the fiscal year 1957 level.

Washington headquarters and extensions.

The increase of $2,050,000 for Washington headquarters and extensions breaks down as follows:

(*1*) *Contributions to civil service retirement fund, $731,000.*—This is the computed amount of costs to be incurred under the Civil Service Retirement Act amendments of 1956 for program direction and administration.

(*2*) *Nonrecurring costs of moving the Washington headquarters, $296,000.*—These are the nonrecurring costs of moving the Washington headquarters to the new location at Germantown, Md. They include such items as moving Government property (office furniture, etc.); shipment of household goods of employees moving to the Germantown area; telephone installations, moves, and termination charges; and security alarm installations.

(*3*) *Maintenance and operation of Germantown headquarters, $399,000.*—This is the estimated cost of utilities and the maintenance of buildings and grounds by the General Services Administration for the last 8 months of the fiscal year at Germantown.

(*4*) *Recurring costs related to operation at the Germantown headquarters, $175,000.*—Additional estimated costs of $190,000 will be incurred during 8 months of operation at Germantown, such as telephone and teletype circuit mileage and rentals, motor transportation costs (GSA motor pool), maintenance and repair of equipment and machines, reporting services, etc. Savings in other items such as guards and elevator operators will amount to $21,000, leaving a net increase of $175,000.

(*5*) *Miscellaneous costs related to increased personnel and foreign offices, $213,000.*—Supplies and miscellaneous services will be required for a full year in fiscal year 1958 for personnel added and foreign offices established during fiscal year 1957. Also, additional costs will be incurred for new foreign offices to be established in fiscal year 1958.

(*6*) *Special studies, employee training and incentive awards, $96,000.*—This estimate includes $75,000 to conduct special studies in the fields of management, job evaluation, and safety problems and practices. The balance of the increase covers a higher activity in the outside training of employees and the incentive awards program.

(*7*) *Information services, $93,000.*—The bulk of these funds is to cover the cost of producing an unclassified motion picture on power reactor developments. Expanding activities necessitate minor increases in funds for still pictures and motion picture prints for official use within the Commission and distribution in discharging the Commission's responsibility for dissemination of information in the field of atomic energy.

(*8*) *Other, $47,000.*—This increase includes $30,000 for payment of tort and patent compensation claims, $15,000 to cover official entertainment of an increasing number of distinguished foreign visitors to the United States and pro-

vide a reasonable allowance to AEC foreign offices for official entertainment, and $2,000 for contributions required under the Federal Insurance Compensation Act and the Government insurance program due to increased average employment in fiscal year 1958.

A comparison of estimates for fiscal year 1957 and fiscal year 1958 by office follows:

Office	Fiscal year 1957	Fiscal year 1958
Grand Junction	$227,000	$303,000
Hanford	357,000	453,000
Oak Ridge	784,000	1,131,000
Savannah River	273,000	387,000
Albuquerque	804,000	1,100,000
San Francisco	180,000	307,000
Chicago	323,000	512,000
Idaho	172,000	276,000
Schenectady	53,000	120,000
New York	218,000	315,000
Subtotal, field offices	3,391,000	4,904,000
Washington headquarters and extensions	2,033,000	4,083,000
Grand total, other objects	5,424,000	8,987,000

4. Equipment, $492,000

This estimate covers the cost of administrative equipment such as office machines and furnishings and motor vehicles and operating equipment required at Washington headquarters and field offices. A net increase of $93,000 over the fiscal year 1957 is requested.

An increase of $159,000 is required for Washington headquarters, which is partially offset by net reductions of $66,000 at various field offices. The principal items accounting for the Washington increase are required for the new headquarters as follows: Radio equipment, equipment for medical services, motion-picture projection equipment, shelter area equipment, lockers for service personnel, library equipment, and various items of office furnishings and equipment.

The amount estimated for fiscal year 1958 is broken down as follows:

Washington headquarters	$355,000
Field offices	137,000
Total	492,000

CIVIL SERVICE RETIREMENT FUND

Mr. CANNON. I would like to ask you here how much of the total in the increase of $6,316,000 is due to payment to the retirement fund.

Mr. FIELDS. $2 million.

Mr. CANNON. A very substantial part.

Mr. FIELDS. Yes, sir. $2 million would be required for contributions to the civil-service retirement fund.

Mr. TABER. Before we get into that, I wonder if we could not have the actual for 1957?

Mr. CANNON. We are asking for that for every program and it will all be in the record throughout.

Mr. TABER. Very well.

FOREIGN TRAVEL

Mr. CANNON. On page 194, for example, you show $72,000 for international travel to conferences and on page 195, $80,000 for atoms-for-peace travel, which are both very substantial amounts for travel. How many people approximately will travel abroad on Atomic Energy

Commission business in 1958, and what will be the approximate cost to the Federal Government?

Mr. FIELDS. We will have that for you in just a moment, sir.

Mr. MCCARTHY. The estimate of foreign travel, Mr. Chairman, for 1958 is $350,000 as compared to $150,000 in 1957. This is for travel to foreign countries, exclusive of some foreign travel to Canada and Puerto Rico on the training program. This is for travel to the European countries and to some of the Far East countries.

Mr. CANNON. Going back to the training program, I see you have an item there of $2.5 million for international conferences. What is the relation between that item and these two items here?

Mr. MCCARTHY. The travel included under the training and education provides for roughly 17 travelers in 1958 who would be traveling in connection with the setting up of the conference. These are not AEC participants in the conference but are those people who are doing the planning and training. The State Department pays for the official delegation, including AEC members who will attend the conference. These will be people who are traveling in connection with the preparation of such conferences.

Mr. CANNON. How many people approximately will travel on AEC business in 1958?

Mr. MCCARTHY. On overseas travel? I have the total dollars but I don't have the number of travelers tied down to that. I will furnish that for the record.

Mr. CANNON. And the approximate cost.

(The information follows:)

FOREIGN TRAVEL

The estimated number of travelers performing foreign travel in 1958 is 218. The estimated cost of such travel in 1958 is $350,000. These estimates exclude travel to Canada, to Puerto Rico on the training program, weapons program foreign travel, travel related to raw materials foreign expoloration and procurement, and travel to Japan related to the Atomic Bomb Casualty Commission project.

EMPLOYMENT FROM 1953 TO 1957

Mr. CANNON. What have been your employment increases each year, year by year, beginning with 1953 down to date?

Mr. FIELDS. May we put that in the record, Mr. Chairman?

Mr. CANNON. Yes.

(The information follows:)

Employment in program direction and administration

Date	Employment	Change during fiscal year
June 30—		
1952	4,840	
1953	5,017	+177
1954	4,429	−588
1955	4,189	−240
1956	4,347	+158
1957	4,616	+269

Mr. FIELDS. Mr. Chairman, in that regard, I am informed that 1953 was the high year for our employment. You will recall at that time we did have a very large construction program in progress at Savannah River and at Hanford. It dropped following that. We will supply the actual growth since that point to this time, sir.

Mr. CANNON. The clerk suggests that you have shown the costs here of moving to your new headquarters, but you have shown no credits in the way of rent savings and so forth.

RENTAL VALUE OF SPACE OCCUPIED IN WASHINGTON

Mr. MCCARTHY. We are presently occupying space controlled by the General Services Administration so we pay no rent at the present time.

Mr. CANNON. What would be the fair value of that commercially?

Mr. MCCARTHY. I would have to get this. I don't know what value GSA puts on that.

(The information follows:)

Estimated commercial rental value of space occupied by AEC at headquarters

1901 Constitution Avenue NW	$224,000
1717 H Street NW	632,000
501 26th Street NW. (warehouse)	19,000
Space in building occupied by AEC in National Bureau of Standards	5,000
Total	880,000

SPECIAL STUDIES, EMPLOYEE TRAINING AND INCENTIVE AWARDS

Mr. CANNON. On page 199, item 6, special studies, employees training, reflects an increase of $96,000 for special studies in the field of management, job evaluation and so forth. What will be your expediture of this type for the current year? You show a provision for studies of $75,000. What would be the corresponding costs for the current year?

Mr. FIELDS. Mr. Chairman, I would like Mr. Smith, who is Director of our Organization and Personnel Division, to answer that.

Mr. SMITH. You are talking about the $75,000 for studies and not the total of $96,000. For fiscal 1957 we estimated the following: first we have a contract on insurance, review of pensions that we use to check the contractors' pension plans and we estimated $8,000 on that. We estimated $19,000 on our health unit which is a part of this total amount here. This is a health room that we have in each building at the H Street and on Constitution Avenue. We have a contract with the Bureau of Labor Statistics for which we estimated $3,500. This is a contract by which they give us a report on the proportion of the payroll that our contractors spend in their private plants for fringe benefits, which we use to compare how they are doing in our plants. We estimated $5,875 on outside training. This covers a variety of things such as sending people to AMA management seminars. We estimated $5,000 on some films, primarily safety films, having to do with the reactor incident at Chalk River, to get what we could out of that in safety training in our own program.

I think that totals up to approximately $73,000.

Mr. CANNON. What we are trying to reach here is the basic cost. You provide that the $75,000 will be an increase over what you spent this year. What have you spent this year so that we can get the total cost?

Mr. FIELDS. These items represented our estimate of costs for this year.

Mr. CANNON. What is the total cost this year to which you are adding this $75,000, so that we will know what the total cost in the next fiscal year will be.

Mr. SMITH. The estimated costs this year were $72,875, from which you have to deduct about $28,000 for awards. My figure includes the awards.

Mr. CANNON. You are asking for an increase of over 100 percent.

Mr. SMITH. We are asking for an increase to $96,000. Part of that increase is also in awards.

Mr. CANNON. Is it necessary to increase those facilities more than 100 percent?

Mr. SMITH. It is not 100 percent. The figure of $72,875 in 1957 compares with the $96,000 for 1958.

Mr. FIELDS. No; it is an increase of $96,000, Mr. Smith.

Mr. CANNON. You have an increase of $75,000 for special studies.

Mr. MCCARTHY. May we supply the breakdown?

Chairman CANNON. Yes; if you will.

(The information follows:)

Comparison of actual fiscal year 1957 costs with fiscal year 1958 estimate for special studies, employee training, and incentive awards

Item	Actual 1957	Estimate 1958	Change from actual 1957
Operation of employee health rooms	$18,000	$25,000	+$7,000
Outside training of employees	6,325	11,025	+4,700
Employee incentive awards program	21,505	39,000	+17,495
Special studies and surveys	25,320	93,500	+68,180
Total	71,150	168,525	[1] +97,375

[1] Differs from increase of $96,000 shown in budget because actual costs for 1957 are reflected in this table.

Mr. CANNON. Also in connection with this will you cite some of the studies in the field of management that have been made and the savings that have been effected as a result of these studies, so that we can see if they justify more than doubling your expenditure in this regard?

Mr. SMITH. We have made none this year, except one which was a study made for the information division by McKinsey & Co. Last year we had one made also by McKinsey & Co.

Mr. CANNON. What did you spend the $75,000 for?

Mr. SMITH. This is what I have just enumerated. These items were not management studies as such. They included review of pension plans of our contractors, for operation of our health unit. This is the type of expense that goes to make up this item. Included was a contract with BLS to review costs that contractors have in their pri-

vate plant so we can make comparisons with our own. Included also are outside training activities of AEC employees, the incentive awards program and some safety training films.

The only management surveys as such that were made this year were one in the field of information services and one having to do with an attitude survey of employees in relation to the Germantown move.

Mr. CANNON. You consider the results secured from those studies so advantageous that you are justified in more than doubling them them for the current year.

INFORMATION SERVICES

Now, let us pass on. There is a $93,000 increase for Information Services. That represents what percentage? We have more than 100 percent increase in the $75,000 item. What percentage increase is represented by this $93,000?

Mr. FIELDS. Mr. Salisbury, Director of Information Services, will answer that question.

Mr. SALISBURY. The amount compares with $51,000 expended in 1957.

Mr. CANNON. This is a $93,000 increase.

Mr. SALISBURY. Yes, sir.

Mr. CANNON. That is an increase over a base of what?

Mr. SALISBURY. $51,000 in 1957.

Mr. CANNON. That is worse still. That is a 200 percent increase. You certainly must have secured very valuable results from your expenditure this year in order to warrant multiplying it by three.

Mr. SALISBURY. The expenditure increase that is contemplated is practically entirely in the production of a motion-picture film on the power reactors which will be used at the Geneva Conference and in the general adult education program throughout the United States.

Mr. CANNON. Is this something new or is this also a part of your program for this current year?

Mr. SALISBURY. No. We did no motion picture film work as completed film work in 1957. We had $21,000 worth of footage which is sold to people making documentary and educational pictures.

FOREIGN OFFICES

Mr. CANNON. Mr. Fields, on page 198, you refer to new foreign offices being established. How many were established in 1957?

Mr. FIELDS. Which item are you referring to, may I ask, Mr. Chairman?

Mr. CANNON. The very last one. It says that you are establishing now foreign offices.

Mr. FIELDS. We established a foreign office in Paris and in London, and there will be one in Tokyo, Mr. Chairman.

Mr. TABER. Did you have any before that?

Mr. FIELDS. No, sir. We did not have any before that. These are offices where we will have a scientific representative to represent the Commission. He will actually report to the ambassador at the embassies.

Mr. CANNON. Is that part of your 1957 program or is that just the 1958 program?

Mr. FIELDS. The Paris and London offices were set up in 1957. In 1958 there will be one in Tokyo. There will also be one in Brazil and Rome. I believe 3 or 4 additional offices are to be set up in 1958. There is a planned total of nine altogether.

Mr. CANNON. You have gotten along very well this year without them. What compelling reason is there to warrant our expending this amount of money in establishing these extra foreign offices?

Mr. FIELDS. Mr. Chairman, the cooperation with the foreign nations that is taking place in conjunction with the atoms for peace program has led to many bilateral agreements regarding the flow of information, materials, research reactors, and collaboration in this whole field is of such a nature that it leads us to believe that effective prosecution requires that we have minimal representation in certain parts of the world. We will have very few people in these offices—2, 3, or 4 in number. There will probably be a scientist, an assistant scientist, and a secretary, and that will be the normal complement as far as we are concerned. We have a great deal to do with the negotiation of bilateral agreements and the arrangements for the flow of information and materials with these countries and the visits of representatives of these countries to be arranged. There is a good deal of advice for which the ambassador looks to our representative in conjunction with atomic energy matters.

Mr. JENSEN. Do any of our friendly nations across the seas have such offices established in the United States?

Mr. FIELDS. Yes, there are several that do; the United Kingdom, France, Belgium, and South Africa. There are a number of them here in Washington.

Mr. JENSEN. They are set up right here in Washington?

Mr. FIELDS. Yes.

Mr. JENSEN. And they have access to your offices?

Mr. FIELDS. Yes, or to conferences.

Mr. JENSEN. And you collaborate and visit back and forth?

Mr. FIELDS. Yes, sir. We have many matters to deal with.

Mr. JENSEN. You think it is necessary for us to set up foreign offices?

Mr. FIELDS. Yes, I think it is necessary so that we have someone on the ground who knows what is going on in these countries. This person can keep abreast of the developments that are going on and follow them with great profit to us in understanding how the whole foreign program is going on.

Mr. JENSEN. You feel that these offices of foreign nations that are here in Washington, D. C., are valuable not only to us but to our friends across the seas?

Mr. FIELDS. I believe so. They must think so or they would not maintain them.

Mr. JENSEN. Do you think so?

Mr. FIELDS. I think they are. They have been helpful in arrangements with respect to the programs involved.

Mr. JENSEN. You feel you can get reliable information from those offices that are set up here in Washington rather than to wait to get that information from the countries that are represented here? Do you think it is expeditious?

Mr. FIELDS. The representatives of those countries are here obviously for their own benefit. We have reasons, I believe, also to have a small number overseas so we can obtain firsthand from them information on the progress and state of the atomic energy programs in these countries. Quite apart from receiving information from a foreign nation who is here representing that country, I think the personal touch is worthwhile.

Mr. JENSEN. You think the personal touch is worth the money?

Mr. FIELDS. Yes, sir, very much.

Mr. JENSEN. That is all, Mr. Chairman.

OFFICIAL ENTERTAINMENT

Mr. CANNON. These entertainment items are always interesting and sometimes informative. I see that you show an increase over last year of $15,000 for official entertainment expenses. How much has been expended for that purpose up to this time?

Mr. MCCARTHY. The limitation on entertainment, Mr. Chairman, is $15,000 in 1957. As I recall the preliminary figure was around $14,500. I will get the exact figure.

(NOTE.—Actual figures were $13,330.)

Mr. STRAUSS. Mr. Chairman, the amount expended considerably exceeds that, but it has come out of the pockets of the Commissioners.

Mr. FIELDS. Mr. Chairman, I might say that some of this increase is for the foreign representation that we were speaking about just before. We have these nine offices at which there will be scientific representatives of the Commission. We are asking for some of this increase so that they can have an allowance for entertainment during the year in the foreign countries.

CONFIDENTIAL FUNDS

Mr. CANNON. You are authorized to expend up to $100,000 for objects of a confidential nature. We have placed that around a substantial figure so there will be no deficit there. How much do you anticipate will actually be expended of that $100,000?

Mr. MCCARTHY. In 1957 I don't believe there has been much expended on the unvouchered money.

Mr. CANNON. You think there will not be during this fiscal year?

Mr. MCCARTHY. There is always a question as to how much will be expended.

Mr. CANNON. We would like to have the exact amount. If you will put that in the record, we would appreciate it.

Mr. STRAUSS. Do you want it in the record?

Mr. CANNON. We want the amount you have spent.

Mr. STRAUSS. But not necessarily the purpose.

Mr. CANNON. No, not the purpose. The amount of the expenditure and the amount which you anticipate will be expended during this fiscal year.

Mr. FIELDS. Yes, sir.

(The information follows:)

CONFIDENTIAL FUNDS

An amount of $24 was expended for items of a confidential nature in fiscal year 1957. Provision is made in the proposed appropriation language for fiscal year 1958 for a continuation of the $100,000 limitation on the expenditure of funds that may be made upon the certificate of the commission.

Mr. CANNON. Are there any questions?

Mr. TABER. I would like to ask one, Mr. Chairman.

COST OF FOREIGN OFFICES

With reference to this item of setting up the foreign offices, what sort of people are included in the group that will cost $213,000?

Mr. FIELDS. Mr. Chairman, in each instance the office will have a top scientist representative. He will be one that normally has a doctor's degree. He will know the atomic energy program thoroughly. He will have had experience in our program so that he is a top civilian employee of the Atomic Energy Commission. He will have a staff assistant normally and then depending on the country and the number of other countries in which he may have to follow programs, he may have 1 or 2 secretaries. This is what our planning is at the moment, sir. There would be one top scientific employee with a staff assistant.

Mr. TABER. That means at one particular spot.

Mr. FIELDS. Yes, he may be in Rio de Janeiro and he would follow the programs of Argentina, Brazil, and the countries in that area. He will have a group of countries with which he will be in contact.

Mr. TABER. How many other people are there involved?

Mr. FIELDS. It varies between 3 and 4 total per office, sir.

Mr. JENSEN. With 9 offices.

Mr. FIELDS. Yes, sir. Actually, we may have an extra person in one in Vienna, our plans are now developing.

Mr. TABER. In these nine offices, you have how many people involved?

Mr. FIELDS. I estimate, at the end of the fiscal year 1958, about 23, sir, as a total. All of our planned offices won't be fully staffed by that time. That estimate is only for six of the offices. The number of offices will grow to 9, but there will be 6 of them in fiscal 1958. We have one in Canada at the present time. He has been there for a long time. We also have one in London and Paris. They take care of some of the other countries.

Mr. TABER. Will they be natives?

Mr. FIELDS. No sir; they are all Americans.

Mr. TABER. How much is the total for this particular activity?

Mr. MCCARTHY. May we furnish that for the record?

Mr. TABER. How much would you figure it will be?

Mr. MCCARTHY. I do not have it recapitulated in one spot.

Mr. TABER. Is it a half million dollars or is it $50,000?

Mr. MCCARTHY. It would be somewhere around half a million dollars, Mr. Taber, including their travel and other emoluments.

(NOTE.—Estimated costs for foreign offices established under the international program are $456,000 for fiscal year 1958.)

Mr. TABER. How many people will be involved?

Mr. MCCARTHY. The plan calls for, roughly, 23 people at the end of 1958.

Mr. TABER. That is the total?

Mr. MCCARTHY. That is correct, for fiscal year 1958.

Mr. TABER. That is the total additional. That does not include the previous years?

Mr. MCCARTHY. That would take care of the total staffing at the end of 1958. The offices will be activated at various times during the year.

Mr. TABER. That is all I have, Mr. Chairman.

Mr. CANNON. Mr. Jensen.

Mr. JENSEN. I was thinking that General Prescott before the Battle of Concord said: "Let no one but Americans be our guard here." Do you remember?

Mr. STRAUSS. Yes.

Mr. JENSEN. I think it would be well in this instance to have only Americans on the job here.

Mr. STRAUSS. I do not think there are any foreign nationals.

Mr. JENSEN. I hope you will only put Americans on the jobs in these offices in the foreign countries, because I think they would be more loyal than any native of any other land could possibly be. A slip-up would wreak havoc to our country.

That is all, Mr. Chairman.

Mr. CANNON. Mr. Kirwan?

Mr. KIRWAN. I have nothing, Mr. Chairman.

Mr. CANNON. Without objection, we will stand adjourned until 2 o'clock this afternoon.

(Afternoon Session)

SECURITY INVESTIGATIONS PROGRAM

Mr. BOLAND. Pages 201 through 208 will be inserted in the record.

(Pp. 201 through 208 of the justification follow:)

SECURITY INVESTIGATIONS PROGRAM, OPERATING COSTS

Program statement

Estimate, fiscal year 1958	$8,772,000
Estimate, fiscal year 1957	8,916,000
Decrease	144,000

This program includes cost of security investigation of individuals for whom clearance is required by the Atomic Energy Act of 1954, as amended. Cost of investigations for licensee applicants and others for whom security clearance is required under the civilian application program is excluded. These are budgeted under "Other costs."

The act of 1954 provides that no individual shall be permitted access to restricted data until the United States Civil Service Commission or, under certain conditions, the Federal Bureau of Investigation, shall have made an investigation and report to AEC on the character, associations, and loyalty of the individual concerned and the AEC shall have determined that permitting such person to have access to restricted data will not endanger the common defense and security.

Published policies and standards provide guidance in determining need for AEC security clearance.

Clearance needs of AEC contractors account for approximately 78 percent of the "Q" type security investigations budgeted for fiscal year 1958. The remaining 22 percent are required for clearance of AEC employees (8 percent), reinvestigations of persons previously cleared (7 percent), and clearance of others, including suppliers and employees of other agencies (7 percent).

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Pursuant to provisions of section 145 (E) of the Atomic Energy Act of 1954, as amended, distribution of total investigative caseload between CSC and FBI is based on Commission-approved criteria. Investigation of personnel for positions of a high degree of importance or sensitivity are referred to FBI; all others to CSC.

Estimated number of new cases to be referred to investigating agencies, number of cases in process, and estimated number of case completions are shown on the following table for full background investigations ("Q") and national agency checks ("L"). Costs are expressed in terms of number of completed cases multiplied by unit cost per investigation ($248.33 for FBI cases; $265,000 for "Q" and $5.05 for "L" type cases handled by CSC). The increases in unit costs for fiscal year 1958 result from enactment of Public Law 854, requiring agency contributions to the civil-service retirement fund.

Summary of estimates

	Actual, fiscal year 1956		Estimate, fiscal year 1957		Estimate, fiscal year 1958	
	Q	L	Q	L	Q	L
1. Number of new cases referred to investigative agency:						
FBI	9,600		8,000		8,000	
CSC	[1] 23,361	5,535	[2] 28,369	4,500	[3] 25,517	4,500
Total	32,961	5,535	36,369	4,500	33,517	4,500
2. Number of cases in process at end of year in investigating agency:						
FBI	846		850		850	
CSC	5,247	97	5,600	250	5,600	250
Total	6,093	97	6,450	250	6,450	250
3. Cases completed during year:						
FBI	11,002		7,996		8,000	
CSC	[4] 20,314	5,711	[2] 28,016	4,347	[3] 25,517	4,500
Total	31,316	5,711	36,012	4,347	33,517	4,500
4. Cost of completed investigations:						
Q clearances:						
Number completed by FBI	11,002		7,996		8,000	
Cost per investigation	$236.00		$236.33		$248.33	
Total cost, FBI	$2,596,452		$1,890,000		$1,987,000	
Number completed by CSC	20,314		28,016		25,517	
Cost per investigation	$241.41		$250.00		$265.00	
Total cost, CSC	$4,904,106		$7,004,000		$6,762,000	
Total cost, Q clearances	$7,500,558		$8,894,000		$8,749,000	
L clearances:						
Number completed by CSC		5,711		4,347		4,500
Cost per investigation		$4.38		$5.05		$5.05
Total L clearance (CSC)		$25,014		$22,000		$23,000
Total security investigations program 8500	$7,525,572		$8,916,000		$8,772,000	

[1] Includes 21
[2] Includes 30
[3] Includes 25
[4] Includes 16

} "L" clearances which require full field investigations.

NOTE.—Average unit costs shown in fiscal year 1956 column.

JUSTIFICATION OF ESTIMATES

The estimated number of cases to be referred for investigation (item 1 of preceding table) is summarized below in terms of categories in which clearances will be required:

Number of full field investigations (Q clearance) requested

Category	Fiscal year 1956 actual	Fiscal year 1957 estimate	Fiscal year 1958 estimate
AEC	2,036	2,401	2,538
Contractor (construction)	1,411	2,959	2,520
Contractor (operating)	23,639	26,801	23,512
All others	2,635	1,608	2,447
Reinvestigations	3,240	2,600	2,500
Total	32,961	36,369	33,517

The AEC program for selective reinvestigation of previously cleared personnel continues in order to assure that the program is protected from individuals whose clearance eligibility may have changed since the time of the last clearance action in their cases.

Full field investigations ("Q" clearance), actual, fiscal year 1956

	AEC direct	Contractor		All others	Total
		Construction	Operating		
Albuquerque	638	298	6,512	586	8,034
Chicago	130		6,448	158	6,736
Grand Junction	150	1	45	59	255
Hanford	35	9	855	54	953
Idaho	150	285	820	70	1,325
New York	133	7	678	32	850
Oak Ridge	150	277	3,175	139	3,741
San Francisco	44		2,540	20	2,604
Savannah River	98	442	1,237	12	1,789
Schenectady	24	12	1,128	39	1,203
Washington area	484	80	201	1,466	2,231
Total	2,036	1,411	23,639	2,635	29,721
		25,050			
Reinvestigations					3,240
Total					32,961

Full field investigations ("Q" clearance), estimated fiscal year 1957

	AEC direct	Contractor		All others	Total
		Construction	Operating		
Albuquerque	765	1,530	9,446	185	11,926
Chicago	155	105	7,169	70	7,499
Grand Junction	160		25	15	200
Hanford	36	10	931	20	997
Idaho	200	592	1,001	45	1,838
New York	195		606	43	844
Oak Ridge	165	268	3,296	22	3,751
San Francisco	30		2,332	25	2,387
Savannah River	62	344	616		1,022
Schenectady	20	25	1,308	39	1,392
Washington area	513	85	171	1,144	1,913
Total	2,301	2,959	26,901	1,608	33,769
		29,860			
Reinvestigations					2,600
Total					36,369

Full field investigations ("Q" clearance), estimated fiscal year 1958

	AEC direct	Contractor		All others	Total
		Construction	Operating		
Albuquerque	780	1,470	8,209	883	11,342
Chicago	175	105	5,283	65	5,628
Grand Junction	160		20	15	195
Hanford	36	10	777	20	843
Idaho	125	591	828	75	1,619
New York	195		768	40	1,003
Oak Ridge	150	114	2,576	60	2,900
San Francisco	75		3,207	50	3,332
Savannah River	60	130	910		1,100
Schenectady	33	10	908	39	990
Washington area	575	90	200	1,200	2,065
Total	2,364	2,520	23,686	2,447	31,017
		26,206			
Reinvestigations					2,500
Total					33,517

National agency checks—"L" type investigations

	Actual, fiscal year 1956	Estimated, fiscal year 1957	Estimated, fiscal year 1958
Albuquerque	2,517	1,635	1,650
Chicago	735	1,028	1,025
Grand Junction	383	207	27
Hanford	311	368	315
Idaho	85	153	214
New York	64	50	80
Oak Ridge	950	627	687
San Francisco	54	20	20
Savannah River	138	187	237
Schenectady	166	190	200
Washington area	132	35	45
Total	5,535	4,500	4,500

Mr. BOLAND. This item shows a decrease of $144,000 for fiscal 1958. I note that the case load will drop from 40,359 to 38.017, or about 5 percent. Can this item be cut a little more than the $144,000, or is that just about the lowest figure you can give us?

Mr. FIELDS. I believe that is the lowest figure we can give you, Mr. Chairman. There is a unit-cost-per-case increase that we have to bear for fiscal year 1958 which arises because of contributions to the civil service retirement fund to be made by the FBI and Civil Service Commission. In other words, it will cost more per case for processing.

Mr. BOLAND. That is due principally to the contribution to the civil service retirement fund.

Mr. FIELDS. Yes, sir.

Mr. BOLAND. Are there any further questions on this item?

Mr. TABER. You have a dropoff in field investigations from thirty-six-thousand-odd to 33,000, or practically 3,000.

Mr. FIELDS. That is true.

Mr. TABER. That is a 10-percent reduction. How much did you spend actually in 1957?

Mr. MCCARTHY. The actual expenditures in 1957 were $8,442,000.

Mr. TABER. Why would not $8 million be sufficient for 1958?

Mr. FIELDS. Mr. Taber, we do have the increase in the cost per case which counterbalances a decrease that we have taken in the estimate of the number of cases to be processed. This is a straight pricing out of an estimate of the number of cases to be processed and we did take a reduction of 3,000 in the number of cases to be processed.

Mr. MCCARTHY. The per-case costs are given to us by the Civil Service Commission and the FBI. These are their costs.

Mr. TABER. Every time these things go through a different set of hands, they run into money. I believe that is all I have.

OTHER COSTS AND REVENUES APPLIED

Mr. BOLAND. Mr. Reporter, will you insert pages 209 through 211 and pages 213 through 218 in the record.

(The justification pages follow:)

OTHER COSTS

Program statement

Estimate, fiscal year 1958	$4,861,000
Estimate, fiscal year 1957	7,535,000
Decrease	2,674,000

Under the program "Other costs" the Commission budgets for costs incurred in the manufacture of materials, which it sells to eligible purchasers and in rendering laboratory, research, and other services to industrial and research organizations through the industrial participation program inaugurated by the Atomic Energy Act of 1954. Commission policy provides for full-cost recovery for products and services, with the exception of the security investigations program, which provides to access permit holders the first 25 investigations free of charge, and discounts on isotopes used for medical and agricultural research, and other minor exceptions approved by the Commission. Reimbursements received by the Commission for the cost of products and services are applied to reduce the Commission's fund requirements. They constitute an offset against "Other costs" and are shown under the program "Revenues applied." The decrease in estimated costs for fiscal year 1958 is related primarily to a reduction in the estimated amount of heavy water sold. The major portion of presently known requirements of foreign governments will be met by deliveries during the fiscal years 1956 and 1957.

Summary of estimates by category

	Acutal, fiscal year 1956	Estimate, fiscal year 1957	Estimate, fiscal year 1958
1. Other costs:			
(a) Cost of special reactor materials	$3,163,620	$3,874,000	$1,256,000
(b) Cost of isotopes	1,530,000	1,770,000	1,785,000
(c) Cost of other products	685,411	10,000	10,000
(d) Cost of services	462,128	663,000	749,000
(e) Cost of security investigations	486,996	1,218,000	1,061,000
Total other costs	6,328,155	7,535,000	4,861,000
2. Related revenue included under program revenues applied	9,113,452	11,448,000	5,823,000
3. Net revenue	2,785,297	3,913,000	962,000

JUSTIFICATION OF CATEGORIES

(a) *Cost of special reactor materials, $1,256,000.*—Includes cost of special reactor materials sold to foreign countries. Related revenue in amount of $2,240,000 is included under program "Revenues applied." Information of a classified nature is presented on page 212.

(b) *Cost of isotopes sold, $1,785,000.*—Includes cost of isotopes produced for

sale or lease to research laboratories, industry, and educational institutions. Related revenue in amount of $2,231,000 is included under "Revenues applied." The increased costs reflect an anticipated increase in sales during 1958.

(c) *Cost of other products, $10,000.*—Includes cost of miscellaneous products produced for sale. Related revenue in amount of $25,000 is included under program "Revenues applied." Sales of miscellaneous products are projected at the 1957 level.

(d) *Cost of services, $749,000.*—Includes cost of irradiation services, research studies, and other services for industry, including charges for use of AEC-owned facilities. Commission policy provides for full cooperation in providing research services in the industrial participation program. Related revenue in amount of $907,000 is included under program "Revenues applied." The rise in costs reflects the anticipation of increased demand for such services in 1958.

(e) *Cost of security investigations, $1,061,000.*—Includes cost of security investigations obtained for access permit holders. As a means of encouraging American industry to participate more fully in the atomic-energy program, the Commission has initiated a program for release of selected classified nonmilitary information, after obtaining the necessary security clearances, to applicants who can demonstrate the information is needed in their business or profession. Each access permit holder is provided with the first 25 investigations free of charge. It is estimated that 2,805 simplified security clearances and 3,950 full field investigations will be completed during fiscal year 1958 for access permit holders at a total cost of $1,061,000 and the Commission will accrue approximately $420,000 in revenue from such security investigations. Estimated revenue is included under the program "Revenues applied" and serves to reduce the appropriation requirement of the Commission.

2. Related revenues included under program revenues applied, $5,823,000

The estimated total revenues related to the sale of products and services included in the program "Other costs" is $5,823,000 as compared to the cost of products and services of $4,861,000, indicating an estimated net revenue to the Commission of $962,000 for the fiscal year. The decrease in the net revenue for fiscal year 1958 is principally due to the decrease in level of sales of special reactor materials.

Additional information of a classified nature is presented on classified page No. 212.

REVENUES APPLIED

Program statement

Estimate fiscal year 1958	$29,819,000
Estimate fiscal year 1957	36,137,000
Decrease	6,318,000

The program, revenues applied, includes the income from sales of products, and services sold to eligible purchasers, and other revenues from community operations, tuition income, hospitals, and other miscellaneous sources, such as income from royalties and collateral funds. The program, revenues applied, is presented in two categories. The first category, revenue from sale of products and services, consists of items for which the related costs are included under the program, other costs, and the second category, other revenues, consists of revenue items for which the costs are reflected under the related program cost, and miscellaneous income such as royalty income, and income from collateral funds.

Revenue from sale of products and services includes revenue from sale of special reactor materials, isotopes, and other products, research and irradiation services and security investigations for access permit holders. Commission policy provides for full cost recovery for products and services, with the exception of the security investigations program, which provides for the first 25 investigations free of charge, and discounts on isotopes used for medical and agricultural research, and other minor exceptions approved by the Commission.

The principal reason for the decrease in revenue of $6,318,000 is attributable to a decreased level of sale of heavy water, and a decrease in revenue from community operations, due to disposal of housing, utility, and commercial properties.

Summary of estimates by category

	Actual, fiscal year 1956	Estimate, fiscal year 1957	Estimate, fiscal year 1958
A. Revenue from sale of products and services (related costs are included under program, "other costs"):			
(1) Special reactor materials	$5,067,304	$7,090,000	$2,240,000
(2) Isotopes	2,297,125	2,213,000	2,231,000
(3) Other products	685,348	25,000	25,000
(4) Services	911,470	809,000	907,000
(5) Security investigations	152,205	1,311,000	420,000
Total	9,113,452	11,448,000	5,823,000
B. Other revenues (related costs are included under applicable program costs):			
(1) Sale of special nuclear materials and vanadium pentoxide	3,294,684	3,225,000	6,297,000
(2) Tuition income	168,259	345,000	420,000
(3) Reserch hospital income	300,602	257,000	207,000
(4) Income from museums and exhibits and sale of publications	81,871	50,000	50,000
(5) Community	20,463,284	18,630,000	14,879,000
(6) Miscellaneous income	2,127,804	2,182,000	2,143,000
Total	26,436,504	24,689,000	23,996,000
C. Total revenues	35,549,956	36,137,000	29,819,000
D. Funds returned to Treasury	6,464,635	0	0
E. Net revenue applied	29,085,321	36,137,000	29,819,000

JUSTIFICATION OF CATEGORIES

A. Revenue from sale of products and services, $5,823,000

The gross revenue from sale of products and services for fiscal year 1958 in amount of $5,823,000 is applied as a reduction of the total appropriation requirement of the Commission; however, it is pertinent to point out that the costs of the products and services amounts to $4,861,000, which costs are included in the program, other costs, as an appropriation requirement. The revenue after deduction of costs is $962,000. The Commission policy provides for full cost recovery for products and services, with the exception of security investigations for access permit holders, and discounts on isotopes used for medical and agricultural research, and other exceptions specifically approved by the Commission.

(1) *Special reactor materials, $2,240,000.*—Estimate includes revenue from the sale of special reactor materials sold to foreign countries. Projected sales for fiscal year 1958 reflect a substantial decrease from fiscal year 1957 due to decreased sales to foreign countries. The related cost for material is $1,256,000 which is included under the program, other costs.

(2) *Isotopes, $2,231,000.*—Estimate includes revenue from the sale and lease of stable and radioisotopes to research laboratories, industry, and educational institutions. The related cost of the products is $1,785,000, which is included under the program, other costs.

(3) *Other products, $25,000.*—Estimate includes revenue from the sale of miscellaneous products. The related cost of the products is $10,000, which is included under the program, other costs.

(4) *Services, $907,000.*—Includes income from irradiation services and special research studies for industry, including charges for use of AEC-owned facilities. Commission policy provides for full cooperation in providing research services in the industrial participation program. Cost of services included under program, "Other costs" is estimated to be $749,000.

(5) *Security investigations, $420,000.*—Includes income from authorized access permit holders for the charges for security investigations. As a means of encouraging American industry to participate more fully in the atomic energy program, the Commission has instituted a program for release of selected classified nonmilitary information, after obtaining the necessary security clearances, to applicants who can demonstrate the information is needed in their business or profession. Each access permit holder is charged for clearance requests in excess of the first 25. The decrease in 1958 is due to the fact that billing reached a peak in 1957 reflecting full implementation of charges to access permit

holders. The related cost for security investigations in fiscal year 1958 included under the program, "Other costs," is $1,061,000.

B. Other revenues, $23,996,000

(1) *Sale of special nuclear materials and vanadium pentoxide, $6,297,000.*—Estimate includes revenue from the sale of special nuclear materials and vanadium pentoxide to industry and foreign countries. Increased revenue is primarily based on projected increased sales of the latter to industry. Vanadium pentoxide is procured by the Commission as a byproduct under certain contracts for the production of uranium oxide. The revenue reflects the sale of vanadium stockpiled in prior years. The related costs of the products were included under the raw materials and special nuclear materials program costs in prior years.

(2) *Tuition income, $420,000.*—Estimate includes revenue for tuition from students attending the Argonne International School of Nuclear Sciences and Engineering, and the Oak Ridge School of Reactor Technology. Increased revenue in fiscal year 1958 is due to an increase in the enrollment at the Oak Ridge School of Reactor Technology of students paying tuition. The tuition charge for the International School of Nuclear Science and Engineering is $2,000 for each student. The tuition charge for the Oak Ridge School of Reactor Technology for industry students is $1,500 for a 6-month course; students from AEC contractors and Government agencies are not charged tuition fees. The related costs, which are included in program costs are $1,160,000, which includes cost of $800,000 for the International School of Nuclear Science and Engineering and $360,000 for the Oak Ridge School of Reactor Technology. The acceleration of student training in the field of nuclear science, and reactor technology, is extremely important to insure trained personnel for the continued development of the atomic energy programs.

(3) *Research hospital income, $207,000.*—Estimate includes income from patients at the Argonne Cancer Research Hospital and Brookhaven Hospital. Decreased revenue for fiscal year 1958 results from an anticipated increase in nonpaying patients for research purposes during the next year. Related costs for the operation of the hospitals are included under the biology and medicine program together with the cost of operation of the cancer research laboratories and related facilities.

(4) *Income from museums and exhibits and sale of publication, $50,000.*—Estimate includes income from the Oak Ridge Museum of Atomic Energy, sale of pamphlets to museum visitors and sale of classified technical publications to access permit holders. Estimate for fiscal year 1958 is projected at the fiscal year 1957 level. Decreased revenue in fiscal year 1957 is due to a policy determination to eliminate rental fees for traveling atomic energy exhibits.

(5) *Community income, $14,879,000.*—Estimate includes the income from the AEC communities of Oak Ridge, Tenn., Richland, Washington, Los Alamos, and Sandia, N. Mex., and Colorado communities. Aggregate income includes revenues from housing and commercial properties, including hospitals, income for municipal services, utility operations, and other miscellaneous sources. The community program schedules, included under the Community Program reflect the revenue by community and category. Related cost of $16,515,000 is included under program costs. The decrease in community revenue of $3,751,000 is due to the projected disposal of housing, commercial and utility properties at Oak Ridge, Tenn., and Richland, Wash.

(6) *Miscellaneous income, $2,143,000.*—Includes income from royalties, interest income from collateral funds and other miscellaneous sources of a general nature.

REVENUES FOR SECURITY INVESTIGATIONS

Mr. BOLAND. This section embraces "Other costs" and "Revenues applied," so we will take the two sections together. Under "Revenue applied," under "Security investigations," you show for 1957, $1,311,000 and a cost of $1,218,000, and a net of some $93,000. In 1958, you show a revenue of $420,000 and a cost of $1,061,000, with a net loss of $641,000. Will you explain why?

Mr. MCCARTHY. The main reason for the difference in 1958, Mr. Chairman, is related to the numbers of free investigations which are given to the access permittees. The Commission's program calls for

the first 25 security investigations for each access permittee to be made on a free basis. The major portion of the investigations we are making now are for small firms which are just now coming into the picture, as a result of which there will be more free investigations than we have had in the past. On the basis of recent experience, this means we are going to get less revenue from the number of investigations we would have to make.

SALE OF VANADIUM PENTOXIDE

Mr. BOLAND. What are the related costs which go with the vanadium pentoxide in 1958?

Mr. MCCARTHY. That is a byproduct material produced in connection with our uranium program. We have a certain number of tons on hand which have been delivered to us. Previously this material was transferred without cost to the national stockpile which now has no use for the material. As a result we plan a sales program. We have shown no costs incurred in this budget because the costs were incurred in previous years.

Mr. BOLAND. How much vanadium pentoxide do you have on hand?

Mr. JESSE JOHNSON. It is approximately 4 million pounds or 2,000 tons.

Mr. BOLAND. You have offered this to the national stockpile?

Mr. FIELDS. They have been taking some for the national stockpile, but this requirement has been met. We now have the problem of disposing of that which is accumulating under our contracts at this time.

Mr. BOLAND. The amount that the AEC has on hand has a total value of how much?

Mr. FIELDS. It is approximately $4 million.

TUITION INCOME

Mr. BOLAND. Item B–2 on page 216, on what basis do you set the tuition for the various schools that are under your supervision?

Mr. FIELDS. The tuition that has been set varies by school and is stated on pages 216 and 217. It is not an attempt to recover the full costs of operation of the school, but is a reasonable charge for the training which takes place during a period of time. It is not the actual cost, however. It is, I believe, comparable to tuition charged in educational institutions for this kind of training.

PUERTO RICAN TRAINING CENTER

Mr. BOLAND. I would like to go back a moment to the Puerto Rican training center. I think I missed the testimony on that date. Is the Commission going ahead with the establishment of the Puerto Rican training center? You have requested $300,000.

Mr. FIELDS. We requested $300,000 in the appropriation before you and there is an item in the plant program for $2,500,000 for provision of facilities and the construction of a reactor at the University of Puerto Rico.

Mr. BOLAND. Is not that really a program that we don't have to go into? Why can't the students of South America attend the schools in the United States without our going into this kind of program?

Mr. FIELDS. We feel that centers should be developed for the conduct of training and education in atomic energy matters for South American students. The language barrier has been a difficult one. We believe the provision in Puerto Rico of facilities which will attract students from all of the South American countries would be of great value in our relations with the South American countries and the promotion of the atoms for peace program in those countries.

Mr. BOLAND. It still would be if they entered schools here.

Mr. FIELDS. We believe we will have more success if it is established in Puerto Rico.

Mr. STRAUSS. There are 2 or 3 other reasons, Mr. Chairman. The transportation costs are very much lower. The living expenses for the students are lower by a degree of magnitude. All of the instruction is carried on in Spanish.

Mr. BOLAND. I can understand the language barrier and the difficulty there.

What do you think the projected cost will be for this school? You start with $300,000 for 1958.

Mr. FIELDS. Our estimate is that it will rise to about a million dollars a year for the support of that school.

SALE OF ISOTOPES

Mr. BOLAND. On the sale of isotopes, what discount do you allow?

Mr. FIELDS. It varies. They pay 20 percent of the published price schedule where it is for purposes of medical research or research in agricultural programs.

Dr. DUNHAM. There is an 80 percent reduction for those purchasing isotopes to be used in medical, biological, and agricultural research, but not for therapy.

Mr. BOLAND. That is all the questions I have on these sections. Are there any questions by other members of the committee?

VANADIUM PENTOXIDE

Mr. JENSEN. Yes. What is the purpose of vanadium pentoxide? How do you use this in your program?

Mr. FIELDS. I would like Mr. Johnson, the Director of Raw Materials, to answer this. This actually comes about by way of our raw materials contracts and was a byproduct. Is this not true?

Mr. JESSE JOHNSON. At the time the domestic vanadium program was initiated in 1948, we had only one source of uranium and that source was a vanadium-bearing uranium ore. The ores had been commercially used for vanadium. The Commission, in endeavoring to get as much uranium as possible, had to purchase the vanadium in excess of the commercial requirements. Up until 1954 or 1955, it was transferred to the national stockpile.

Mr. JENSEN. So it is an element in the atomic bomb?

Mr. JESSE JOHNSON. No, it is not used in our program. It is an alloy material for steel. It was in great demand during World War II and also during the Korean war for armorplate for tanks and various steels.

Mr. JENSEN. What does it do to steel? Does it make it harder?

Mr. JESSE JOHNSON. I think primarily tougher. It is also used in the automotive industry and there are a number of other commercial

uses. We anticipate being able to sell the material on hand at the cost to the Commission plus handling charges, at least.

Mr. JENSEN. So it is necessary to purchase vanadium pentoxide in order to get uranium in sufficient quantity.

Mr. JESSE JOHNSON. That was the situation when we established our program. We have eliminated quite a few of our commitments to purchase the vanadium. We still have the commitment to the uranium ore miner who sells an ore that contains both vanadium and uranium. If there is an excess supply of vanadium the surplus has been taken over by the Commission. We have had very little delivered to us in the last 2 years and I anticipate the way the market is that we would have no future problem on receiving any quantities of surplus vanadium.

Mr. JENSEN. Is there any market for it?

Mr. JESSE JOHNSON. There is a ready market and has been for the last 2 years for the material that has been currently produced, except for this quantity of 4 million pounds, most of which was received in fiscal year 1955. I think practically none was received in fiscal year 1957, and very little in fiscal year 1956.

Mr. JENSEN. What do the steel companies use instead of vanadium pentoxide to toughen their steel?

Mr. JESSE JOHNSON. There are a number of alloy materials such as tungsten, molybdenum, and chrome. They all impart different properties to the steel. Vanadium has certain special uses in making alloys for commercial uses as well as for military uses.

PUERTO RICAN TRAINING CENTER

Mr. JENSEN. Thank you. With reference to this school you are establishing in Puerto Rico, will it be manned by American instructors, generally speaking, or are you bringing experts in the nuclear sciences from other nations as well?

Dr. DAVIS. I believe the school would be staffed primarily by people from the faculty there. I would expect they would invite people to come down to give lectures. I think the intent is to provide the whole curriculum in the language which the people from South America would be speaking. So I think it would be primarily the staff as built up there by themselves.

Mr. JENSEN. Are they well enough informed on nuclear sciences to give proper instruction to their students?

Dr. DAVIS. This would be a part of the problem. As you may recall in our discussion of the education program, we are devoting quite a bit of effort to faculty training with the idea that you can take these persons who are primarily faculty members in engineering, physics, mathematics, and help them get caught up on developments in atomic energy, so that they can in turn teach students in these subjects.

Mr. STRAUSS. Mr. Jensen, I can supplement Dr. Davis' statement to this extent. I attended the opening of this institution in January of this year. It was carried on on two campuses of the university, one on the north and the other on the south coast of the island. The lectures were in both English and Spanish. They were very well attended. The student body is large and consists of students not only from the Latin American countries, but a number of European countries. The instructors include men who have been trained abroad

and in our own universities as well. I would expect and they expect that over the years they will have visiting instructors and lecturers from the United States.

Mr. JENSEN. Have any of these instructors been with the Atomic Energy Commission in any capacity?

Mr. STRAUSS. Those who delivered lectures at the opening included a number of people from here who had gone down for the purpose.

Mr. JENSEN. You mean from the United States?

Mr. STRAUSS. Yes.

Mr. JENSEN. And people who had been with the Atomic Energy Commission?

Mr. STRAUSS. Had been, and are.

Mr. JENSEN. And are still?

Mr. STRAUSS. Yes. They are not attached to the faculty of the University of Puerto Rico. They were visitors.

Mr. JENSEN. Will they still be in the employ of the United States?

Mr. STRAUSS. When they visit for the purpose of making a lecture, I presume so. That is not an unusual matter.

Mr. JENSEN. Under the jurisdiction of the Atomic Energy Commission?

Mr. STRAUSS. They will be employees either directly of the Commission as in the case of Dr. Goodman, or employees of contractors of the Commission, if they come from Oak Ridge or Brookhaven or one of the other laboratories.

Mr. JENSEN. Of course, what I am interested in would be to know that these instructors and this whole program that is to be established in Puerto Rico will be under the jurisdiction of the Atomic Energy Commission of the United States of America.

Mr. STRAUSS. I think I understand your concern.

Mr. JENSEN. The American people would naturally hope and expect that the Atomic Energy Commission would have full knowledge of what was going on all the time in that institution.

Mr. STRAUSS. These lectures are all public lectures. They are not on matters of ideology or policy, but on technical matters. They have to do with the application of atomic energy to agriculture, which is of great concern to Puerto Rico, to the application of atomic energy to the production of power which is of particular concern to Puerto Rico. There was in our budget request an item of $9 million for a power reactor to be built in Puerto Rico to which the Puerto Rican Government was itself making a substantially smaller but for them a large contribution. Also, the use of isotopes generally is important in the industrialization of Puerto Rico, which as I am sure you know, has made very great progress, and which will have to make a great deal more progress in order to absorb the continual increase in the population of the island.

PRIVATE INDUSTRY IN PUERTO RICO

Mr. JENSEN. Private industry is almost completely in charge of all industry in Puerto Rico, is it not, now?

Mr. STRAUSS. I am unable to answer that, Mr. Jensen. The power production in Puerto Rico is conducted by a water resources authority, which is a government operation, but I believe most of the industry in the island is privately owned. They have made offers on an

attractive basis to industry in the United States and have had a very substantial response to it. The island has expanded enormously in its industrial output in the last 10 or 15 years.

Mr. JENSEN. I know that, and I am very happy about it. A number of years ago a man was sent from this country down there to try to improve the economy of the country, and the longer he stayed, the worse the economy of that country became. Finally he was taken out of that country and private industry again was put at work and since that time they found that the country improved tremendously. I was there a number of years ago.

I have just one more question, Mr. Chairman.

CLASSIFIED MATERIAL AT PUERTO RICAN TRAINING CENTER

Will anybody at this institution other than the American officials and American lecturers have access to classified information?

Mr. STRAUSS. No restricted data or classified information is involved in that instruction at all.

Mr. JENSEN. Not at all?

Mr. STRAUSS. Not at all.

Mr. JENSEN. I am glad to know that. That is all, Mr. Chairman.

Mr. BOLAND. Mr. Taber.

Mr. TABER. You have not gone into selected resources.

Mr. BOLAND. Not yet.

Mr. TABER. Then I have nothing.

SELECTED RESOURCES

Mr. BOLAND. The next section deals with selected resources and we will insert pages 220 through 229, and 234 through 241.

(The justification pages follow:)

INCREASE OR DECREASE IN SELECTED RESOURCES

Estimate, fiscal year 1958	$1,019,151,196
Estimate, fiscal year 1957	764,373,528
Increase	254,777,668

The program, increase or decrease in selected resources, presents the net increase or decrease in levels of resources required to support the program requirements of the Commission. The program includes requirements for inventories, collateral funds, and undelivered orders. The category, undelivered orders, includes contracts for materials and services to be delivered after fiscal year 1958, and financing of contractors, in accordance with Commission policy beyond the end of the fiscal year, to insure continuity of operations. The levels of selected resources are assets that may be applied to program costs of future years' operations.

Appropriation requirements for fiscal year 1958 are $254,777,668 to finance increased levels of inventories, and goods and services on order to support the continuing increase in the Commission programs. The increase of $254,777,668 in fiscal year 1958 provides for an increase of $22,426,000 for inventories and an increase of $234,451,668 for goods and services on order and a decrease of $2,100,000 in requirements for collateral funds.

The increase in inventories consists of $22,416,000 for special reactor materials reserve inventories, $1,543,000 increase in stores inventory for expanded production operations, $504,000 for increase in isotopes inventory required to support increased research activity, and a decrease of $2,037,000 for other special materials.

The increase of $234,451,668 for goods and services on order is principally required for increased weapons production, research and development programs for the weapons and reactor development programs including the aircraft nuclear propulsion program, increased levels of production of source and special nuclear materials, and increased levels for the power reactor agreement program.

Summary of estimates by category

Balances at end of year	Actual, fiscal year 1956	Estimate, fiscal year 1957	Estimate, fiscal year 1958	Increase or decrease
1. Inventories:				
(a) Stores	$83,384,103	$80,116,000	$81,659,000	$1,543,000
(b) Special reactor materials	33,735,660	49,816,000	72,232,000	22,416,000
(c) Other special materials	18,390,897	13,736,000	11,699,000	−2,037,000
(d) Isotopes	359,000	830,000	1,334,000	504,000
Total inventories	135,869,660	144,498,000	166,924,000	22,426,000
2. Collateral funds	21,890,000	20,790,000	18,690,000	−2,100,000
3. Goods and services on order	559,672,868	599,085,528	833,537,196	234,451,668
Total unapplied resources at end of year	717,432,528	764,373,528	1,019,151,196	254,777,668
Increase in selected resources	91,906,254	46,941,000	254,777,668	

JUSTIFICATION OF CHANGES

1. Inventories, increase, $22,426,000

AEC inventories are normally financed by the issue of inventory items to users or purchasers whose programs or accounts are charged for the cost of the items as they are withdrawn from stock. Funds made available to inventory accounts by these issues or sales are then used for replenishing inventories. It is only when the total inventory level must be increased to serve new or expanded activities that additional appropriated funds are required. In fiscal year 1958 an additional $22.4 million is required to increase levels of special reactor materials, principally heavy water and buckside for AEC use and stockpiling for the industrial participation program. The increase of $1.5 million in stores inventory is related to expanded weapons production levels. The fiscal year 1958 budget includes inventory levels and changes for isotopes inventories not previously included. Details of requirements are discussed under titles of "Stores," "Special Reactor Materials," "Other Special Materials," and "Isotope Inventories."

(a) *Stores inventory, increase, $1,543,000.*—Stores inventories are supplies, materials, and parts normally used or consumed in the production of source and special nuclear materials, in the maintenance of production plants, buildings, and other facilities, or in the operation of laboratories and experimental projects, towns, and administrative activities. Stores exclude source and special nuclear materials, weapons components, reactor materials, and other special materials. Included in the AEC stores inventory are the following kinds of items:

Mechanical materials and supplies
Metals and metal alloys
Electrical materials and supplies
Fuels and lubricants
Chemicals and compounds
Building and road materials and supplies
Electronic supplies
Hardware and small tools
Laboratory supplies
Motor vehicle parts and accessories
Heavy mobile equipment parts and accessories
Office materials and supplies
Clothing
Custodial materials and supplies
Medical materials and supplies
Special process spares
Stores work in process
Returnable containers
Scrap

Stores inventory is divided into the following categories:

Current-use stores are those materials, supplies, and parts stocked for use in the active operating programs of AEC.

Standby stores include only those materials, supplies, and parts held for future operation of facilities placed in standby; those items stocked solely for use in case of disaster, invasion, sabotage, fire, or explosion; and those specifically authorized to be stockpiled.

Excess stores are those materials, supplies, and parts generated by AEC operating programs which have been determined excess to the needs of an AEC office or an AEC contractor as well as those determined excess to the entire AEC operation.

The fiscal year 1958 net stores inventory increase of $1,543,000 is primarily due to the additional current-use stocks required for expanded operations.

Changes in inventory levels during fiscal year 1958 are tabulated below:

	Estimate, fiscal year 1957	Estimate, fiscal year 1958	Increase or decrease (−)
Washington raw materials	$16,000	$16,000	0
Grand Junction	456,000	456,000	0
Hanford	8,924,000	8,924,000	0
Oak Ridge	36,657,000	36,230,000	−$427,000
Albuquerque	16,694,000	18,197,000	1,503,000
San Francisco	1,462,000	1,618,000	156,000
Idaho	741,000	727,000	−14,000
Chicago	2,813,000	3,108,000	295,000
Schenectady	858,000	858,000	0
New York	440,000	430,000	−10,000
Savannah River	11,055,000	11,095,000	40,000
Total	80,116,000	81,659,000	1,543,000

The reasons for specific major increases are explained by operations offices.

Albuquerque, increase, $1,503,000: An increase of $1.0 million is required for Bendix Aviation and $0.2 million for Procter & Gamble for expanded weapons production. Balance of $0.3 million is net of minor increases and decreases related to production activities.

San Francisco, increase, $156,000: Increase required to support expanded program operations at Berkeley and Livermore.

Chicago, increase, $295,000: Increases are required principally to support expanded research and development programs under Argonne National Laboratory, Westinghouse Electric Corp., and General Electric Co.

(*b*) *Special reactor materials inventory, increase, $22,416,000.*—This inventory consists of stocks of matrials used in the construction and operation of reactors for production and research purposes. The increase in fiscal year 1958 will provide for operational requirements and stockpiling of inventory of heavy water. Decrease in projected sales of heavy water partially accounts for inventory buildup.

Additional information of a classified nature is presented on page 230.

(*c*) *Other special materials inventory, decrease, $2,037,000.*—Other special materials inventory is made up of the following items, requiring special accounting controls: Gold, silver, platinum, radium, radium sludge, palladium, rhodium, and barrier items.

(*d*) *Isotopes inventory, increase, $504,000.*—AEC has established a policy to place isotopes inventory under formal accounting controls, and financial presentation under the category of selected resources, due to the expanding use in research and increase in sale and loan activities. Pending actual physical inventories, the inventory levels are presented on a computed basis and are subject to adjustment. Inventory increase is based on anticipated increased sales and loan of isotopes, and the return to inventory of loaned special isotopes after initial use for storage and subsequent reuse in research programs.

2. Collateral funds, decrease, $2,100,000

These funds consist of insurance collateral funds, employee benefit and annuity funds established under contracts which were originally entered into by the War Department. They were designed to provide for various extraordinary contingencies in the activity of cost-type contractors. For the most part, these funds are held by trustees and invested in United States Government securities. No additional funds have been established for the 2 years under consideration.

The following table indicates the status of the collateral funds as of the end of fiscal years 1957 and 1958 by office:

Office and contract	Estimate, fiscal year 1957	Estimate, fiscal year 1958	Increase or decrease (−)
Balance at close of year:			
General Electric insurance fund, Travelers Insurance Co.	$10,500,000	$10,500,000	0
DuPont insurance fund, Travelers Insurance Co.	2,100,000	0	−$2,100,000
Albuquerque: Los Alamos, University of California employees benefit fund	1,000,000	1,000,000	0
San Francisco: Berkeley, University of California employees benefit fund	490,000	490,000	0
Chicago: University of Chicago employees benefit fund	500,000	500,000	0
New York: Columbia University employees benefit fund	200,000	200,000	0
Washington: University of California, Los Alamos, and University of Chicago insurance fund, Royal & Globe Co.	6,000,000	6,000,000	0
Total collateral funds	20,790,000	18,690,000	−2,100,000

3. Goods and services on order, increase, $234,451,668

This item includes undelivered balances of materials, supplies, and services on order under outstanding purchase orders and contracts. The amounts estimated reflect the unpaid obligations under contracts and purchase orders outstanding at the end of the year, less net accounts payable and accrued liabilities for goods and services received and charged to costs.

The increase of $234.5 million in fiscal year 1958 is the net of the following increases and decreases in "Goods and services on order":

	In millions
Increases:	
Increase in operation of facilities	$165.9
Increase for power reactors cooperative agreements	54.7
Increase for research and development contracts other than operation of facilities	24.4
Total increases	245.0
Decreases:	
Decrease in major procurement	9.2
Decrease in utility contracts	1.0
Decrease in other miscelloneous contracts	.3
Total decreases	10.5
Net increase in "Goods and services on order"	234.5

[In thousands]

	Fiscal year 1956 actual	Estimated, fiscal year 1957	Estimated, fiscal year 1958	Increase or decrease (−)
1. Operation of facilities:				
(*a*) Production of source and special nuclear materials	$230,664	$234,932	$284,290	$49,358
(*b*) Production of weapons and weapons components	59,718	55,505	130,447	74,942
(*c*) Research and development	113,337	133,813	185,336	51,523
(*d*) Supporting facilities	10,425	24,849	14,983	−9,956
Total	414,144	449,099	614,966	165,867
2. Major procurement	59,792	67,897	58,688	−9,209
3. Research and development other than operation of facilities	47,695	58,032	137,168	79,136
4. Utility contracts	8,250	7,072	6,079	−993
5. All other	29,792	16,985	16,636	−349
Total	559,673	599,085	833,537	234,452

1. *Operation of facilities, increase, $165,867,000.*—The estimates generally provide forward financing of 3 months for research facilities and 6 months for production facilities in addition to the level of outstanding commitments at the end of the period. Increases by types of facilities are listed below:

(*a*) Production of source and special nuclear materials, increase, $49,358,000: Increase is required for higher operating levels at the major production plants at Oak Ridge, Savannah River, and Hanford and supporting feed plants.

(*b*) Production of weapons and weapons components, increase, $74,942,000: Increase is required for a higher level of weapons production, related to increased availability of materials.

(*c*) Research and development, increase, $51,523,000: Increase required to finance higher operating levels of research and development, principally for expanded weapons research programs and the civilian power reactor programs. Additional information of a classified nature is presented on page 231.

(*d*) Supporting facilities, decrease, $9,956,000: Decrease related to decrease requirements for weapons test support due to phasing of tests.

2. *Major procurement, decrease, $9,209,000.*—Decrease is related to amortization of cancellation liabilities for procurement of lithium, and application of prior advances to fiscal year 1958 deliveries from the combined development agency. Additional information of a classified nature is presented on page 232.

3. *Research and development other than operation of facilities, increase, $79,136,000.*—This estimate includes an increase of $54.7 million for the power reactor cooperative agreement program to further the advancement of civilian power technology, $14.1 million for new research and development contracts and higher levels for existing research and development contracts, and $10.3 million for classified projects.

4. *Utility contracts, decrease, —$993,000.*—Decrease represents a reduction in the cancellation liability under the contract with the East Tennessee Natural Gas Co. for the supply of gas at Oak Ridge, Tenn.

5. *All other, decrease, —$349,000.*—Decrease represents a reduction in the level of AEC obligations for miscellaneous contracts.

Additional information of a classified nature is presented on the following classified pages 230 through 233.

ALL PROGRAMS—AEC DIRECT EMPLOYMENT

	Actual, fiscal year 1956	Estimate, fiscal year 1957	Estimate, fiscal year 1958
Number of permanent civilian employees at end of fiscal year	6,583	6,868	7,062
Average number of permanent civilian employees	6,230	6,798	6,969
Man-year equivalent for terminal leave payments	51	47	46
Total man-years of full-time employment	6,281	6,845	7,015
Personal services cost	$39,355,856	$43,950,000	$46,100,000

It is the basic policy of the Commission to conduct the atomic-energy program through contractors to the greatest practical extent. The following functions are performed by AEC employees within this basic policy: (1) Program planning and direction, contract negotiation, liaison with contractors, and inspection of contractor products; (2) administration of civilian application, licensing, and international cooperation activities; (3) security measures including screening of personnel, protection of documents and property, guarding of security shipments, and patrolling of sites where contractor-guard service is not provided; (4) direct participation in domestic and foreign raw materials exploration; (5) operation of storage sites; (6) operation of the New Brunswick Laboratory and New York Health and Safety Laboratory; (7) operation of the Los Alamos communications facilities, fire and police departments, and radiation monitoring services; (8) accounting, auditing, property management, and personnel services, assuring adequate controls by AEC offices and contractors; (9) control and dissemination of scientific and technical information; and (10) provision of supporting services at the AEC Washington headquarters and field offices.

The net increase of 194 employees requested for fiscal year 1958 results from an increase of 178 employees for program direction and administration program activities in field offices which is explained in the narrative justification of operating costs for that program, and a net increase of 16 employees in other programs.

Evaluation of personnel requirements for exploration activities indicates that in the raw-materials program a reduction of 12 employees for domestic-exploration activities can be made and that an increase of 4 employees will be required for foreign-exploration activities, for a net strength reduction of 8 for the program. Slight increases in personnel will be required for the weapons and reactor development programs due to program expansions. A reduction of two employees in the community program will be possible as a direct result of the community disposal program.

The following table provides a comparison of average employment, year-end strength, and personal services costs for each of the Commission's programs for fiscal year 1957 and fiscal year 1958:

Program	Fiscal year 1957			Fiscal year 1958		
	Average full-time employment	End strength	Costs	Average full-time employment	End strength	Costs
			Thousands			*Thousands*
Raw materials	335	239	$1,953	231	231	$1,500
Special nuclear materials	203	207	1,318	202	206	1,342
Weapons	1,162	1,178	6,790	1,193	1,204	7,120
Reactor development	201	211	1,172	212	212	1,255
Biology and medicine	83	85	533	80	85	517
Training, education, and information	172	178	935	178	178	986
Community	130	132	784	127	130	773
Program direction and administration	4,512	4,638	30,465	4,746	4,816	32,607
Total	6,798	6,868	43,950	6,969	7,062	46,100

ALL PROGRAMS—TRAVEL

	Fiscal year 1956 actual	Fiscal year 1957 estimate	Fiscal year 1958 estimate
Estimated number of travel-days	126,660	137,725	143,445
Total estimated cost	$2,818,563	$3,400,000	$3,900,000

Funds requested for travel are required for reimbursement to Commission employees and to pay their transportation expenses while discharging their assigned duties away from official-duty stations. Some employees of the Commission spend the major part of their duty time away from their official station. These employees consist of geologists and mining engineers in the raw materials program, and shipment security guards in the special nuclear materials, weapons, and reactor development programs. Travel is also heavy in connection with weapons production, inspection and storage activities, audit and inspection functions, international cooperation program, as well as activities dealing with civilian uses of atomic energy.

A decrease in fiscal year 1958 for the raw materials program is due to a reduction in domestic exploration travel partially offset by an expected increase in foreign cooperation exploration programs as well as more foreign exploration programs of a reconnaissance nature. Additional funds are being requested in fiscal year 1958 for the special nuclear materials program which is due to increased production and shipment of materials which will require security escort protection while in transit. The increase in travel requirements for the weapons program is directly related to an increase in the overall scope of the weapons program which involves a greater number of contractors, plants, storage sites and volume of security shipments. A moderate increase is projected for the reactor development program based on an increase in the number of plant locations necessitating a larger number of security shipments. The greatest increase is attributed to administrative travel for program direction and administration for overall supervision of the Commission's activities. Factors contributing to the increase in administrative travel are expansions in the weapons and reactor development programs, an increase in the program of civilian appli-

cation of atomic energy on the part of private industry, and a greatly expanded foreign cooperation program.

The following table reflects a comparison of the estimated days of travel and estimated costs of the various programs for fiscal year 1957 and fiscal year 1958:

Program	Fiscal year 1957 estimate		Fiscal year 1958 estimate	
	Days	Cost	Days	Cost
Raw materials	37,878	$375,000	26,254	$267,000
Special nuclear materials	10,532	228,000	12,886	280,000
Weapons	22,737	668,000	23,834	700,000
Reactor development	3,046	64,000	3,308	70,000
Biology and medicine	1,695	46,000	1,695	46,000
Training, education, and information	120	4,000	120	4,000
Community	155	5,000	155	5,000
Program direction and administration	61,562	2,010,000	75,193	2,528,000
Total	137,725	3,400,000	143,445	3,900,000

Contributions to Civil Service Retirement Fund

The Civil Service Retirement Act Amendments of 1956 (Public Law 854, 84th Cong.) provide that from and after the first day of the first pay period which begins after June 30, 1957, each agency shall contribute to the retirement fund a sum equal to the retirement deduction from employees' salaries. The contribution to be costed to the appropriation, "Operating expenses, Atomic Energy Commission," in fiscal year 1958 is estimated as follows:

Program:	*Amount*
Raw materials	$87,000
Special nuclear materials	65,000
Weapons	382,000
Reactor development	66,000
Biology and medicine	30,000
Training, education, and information	55,000
Community	44,000
Program direction and administration	1,986,000
Total	2,715,000

Statement on Passenger Carrying Motor Vehicles

	Actual 1956	Estimate 1957	Estimate 1958
Net active fleet end of fiscal year	2,218	2,212	2,160
Number of replacement vehicles	478	306	460
Gross cost of replacement vehicles	$902,321	$847,160	$2,043,794

Passenger motor vehicles are required by the AEC for security patrols of extensive plant and laboratory areas, management and administration of AEC-owned communities, inspection and audit of Commission and contractor-operated facilities, and for other necessary official transportation of AEC and contractor personnel within and between project sites and areas in the management and operation of the programs conducted by the agency.

Table A below shows the passenger motor-vehicle requirements, by type, for fiscal year 1958. The estimate includes requirements for both contractor operations, and the AEC. The motor vehicles requested are for replacement purposes only, and meet or exceed the GSA replacement standards. Steps have been taken to reduce the total fleet as shown in table B.

TABLE A.—*Passenger motor vehicle replacement requirements*

	Actual, fiscal year 1956		Estimate, fiscal year 1957		Estimate, fiscal year 1958	
	Number	Cost	Number	Cost	Number	Cost
Automobiles	433	$543,038	228	$346,010	329	$490,700
Station wagons	27	56,210	42	85,900	39	78,819
Ambulances	1	3,477	5	33,300	7	37,400
Buses	17	299,596	31	381,950	85	1,436,875
Total replacements	478	902,321	306	847,160	460	2,043,794

TABLE B.—*Net active fleet of passsnger motor vehicles at end of year*

	Actual, fiscal year 1956	Estimate, fiscal year 1957	Estimate, fiscal year 1958
Automobiles	1,620	1,587	1,543
Station wagons	111	132	127
Ambulances	59	60	60
Buses	428	433	430
Total	2,218	2,212	2,160

The Atomic Energy Commission has an active program to promote more effective utilization of equipment, principally through increased use of AEC and GSA motor pools. This program, together with the completion of major construction has resulted in some reduction in the total vehicle fleet, even though operating programs have continued to expand.

OPERATING EXPENSES, ATOMIC ENERGY COMMISSION

Comparative statement of obligations by object classification

Object classification	1956 actual	1957 estimate	1958 estimate	Increase or decrease (—) 1958 over 1957
ATOMIC ENERGY COMMISSION				
01 Personal services	$39,351,162	$43,950,000	$46,100,000	$2,150,000
02 Travel	2,810,970	3,400,000	3,900,000	500,000
03 Transportation of things	5,642,745	5,644,000	6,294,000	650,000
04 Communication services	2,677,683	2,993,000	3,139,000	146,000
05 Rents and utility services	232,402,621	234,084,000	210,297,000	−23,787,000
06 Printing and reproduction	710,795	618,000	733,000	115,000
07 Other contractual services	823,015,457	925,102,748	1,347,822,668	422,719,920
Services performed by other agencies	14,774,666	30,899,000	28,477,000	−2,422,000
08 Supplies and materials	278,879,098	431,021,000	661,117,000	230,096,000
09 Equipment	47,421,610	62,132,000	88,815,000	26,683,000
11 Grants, subsidies, and contributions	727,884	4,619,000	7,900,000	3,281,000
Contributions to retirement fund	0	0	2,715,000	2,715,000
13 Refunds, awards and indemnities	73,131	93,000	135,000	42,000
15 Taxes and assessments	3,831	4,000	4,000	0
Unvouchered	248	100,000	100,000	0
Total AEC obligations	1,448,491,901	1,744,659,748	2,407,548,668	662,888,920
Total obligations under transfer appropriations	27,559,338	16,873,252	16,546,000	−327,252
Grand total obligations	1,476,051,239	1,761,533,000	2,424,094,668	662,561,668

FINANCING OF CONTRACTORS

Mr. BOLAND. $1,347,822,668 is included for contractual services in the 1958 budget. That table is on page 241. I believe there are funds you do not actually have to spend until after fiscal year 1958 has ended, and will probably be spent in the first half of 1959. How much of

this total is involved in that category and why is it necessary to appropriate funds now which will be spent in 1959? What is the total?

Mr. FIELDS. I will ask Mr. McCarthy to give you the breakdown but there is involved in here the financing of undelivered orders and contracts for materials and services to be delivered after 1958, and financing the contractors for a period after the end of the fiscal year. We follow the practice of financing our industrial contractors for 6 months and the university research and development contracts for 3 months after the end of the fiscal year.

This subject was looked into by your committee about 3 years ago very extensively. At that time we provided financing for a full year after the end of the fiscal year for all operations. As a result of your review, we have cut back the period to 6 months for industrial concerns. This relates to the continuing types of operations such as the large plant at Hanford and Oak Ridge, where we have forward financing for 6 months. In the research and development contracts, which are also continuing-type contracts, such as the University of California at Los Alamos and the weapons laboratories, we have reduced the period to 3 months. That is primarily what is involved. Mr. McCarthy has the detail as to the actual amounts.

Mr. MCCARTHY. The amount included for that purpose is $459,845,000, which would be the carryover amount at the end of 1958 to cover the contracts on the 3 and 6 months' bases in fiscal 1959.

Mr. BOLAND. Will you break that down for the amount of research which would carry over for 3 months and the amount which would carry over for 6 months?

Mr. MCCARTHY. Yes, sir. For the production of source and special nuclear materials, the total is $234,447,000. There are two small contracts in this amount which are on a 32-month basis. For production of weapons plants, the amount is $92,352,000. A small number of these are also on a 3-month basis.

For research and development, the amount is $120,363,000, all of which are on a 3-month basis. For supporting facilities, the amount is $12,683,000.

Mr. BOLAND. What are the supporting facilities?

Mr. MCCARTHY. This includes the contractor who operates the Eniwetok Proving Grounds and the Reynolds Electric Co., which operates the Nevada test site. These are the two major ones that are included in this category.

Mr. BOLAND. Isn't it possible to bring the operating contracts down to a less than 6 months' basis and prefinance for less than 6 months? As you indicate, it was for a full year before this committee looked into that and then you dropped from 24 to 18 months. Is it possible to drop it lower? Why do you give it to them—on the possibility of severance?

Mr. FIELDS. Yes. It is for continuity of operation and assurance to their employees. This period of time—6 months—permits a period of adjustment to a level depending on what the Congress decides to appropriate for these programs. It provides a reasonable period in which you can reflect the changes in the program and at the same time give assurance for continuity of operations. We only apply this method to the major continuing contracts.

Mr. MCCARTHY. In most cases it is estimated that the amounts involved under these contracts approximately amount to severance costs

if the facility was cut off. So in lieu of this, if we were to write our contracts on a fiscal year basis, the contractor would probably require some such amount to cover him in case of termination at the end of the year. Involved are the shutdown of the plant, travel-home pay, and severance pay of his workers.

Mr. BOLAND. What has been the experience of the Commission in the amount of money that the Congress has appropriated for this particular section? Has it cut it back or has the Congress generally given what you wanted in relation to these facilities?

Mr. FIELDS. The Congress has generally acceded to our request in every fiscal year that I recall.

Mr. BOLAND. I would think that the contractors would have some faith in Congress as a result of that experience with the result that the Commission would not require this 6-month period on the question of operations. I can see it with respect to the question of research.

Mr. FIELD. I think it is helpful to have some period of financing for this operation.

Mr. BOLAND. If it were cut back to 3 months would that be too short a period of time?

Mr. FIELDS. I don't know. I didn't go through the review myself at the time when the period was changed from a year to 6 months. I do know that this kind of arrangement does give a feeling of confidence on the part of the contractor which assists us in the prosecution of the work under the contract. As you know, we operate under major contracts for the operation of these manufacturing facilities. We always have done this, much more so than other Government agencies. I think it has been a characteristic of our success and that this arrangement has contributed something to the confidence of our contractors in the firmness with which they could look at their programs some 18 months into the future. It does help very materially. As I say, I was not involved in the discussions with the committee when the period was cut back from a year to 6 months. It would be a matter of opinion and judgment as to just what this would do to us if it was reduced from 6 months to 3 months.

Mr. BOLAND. If it were cut back 6 months to 3 months, what part of the $460 million would be required?

Mr. MCCARTHY. I think I have a rough figure here. I think there would be $157 million involved, Chairman, which would be applicable to those contracts which are funded the 6 months operation of facilities.

Mr. BOLAND. Would we actually injure the program of the AEC if we cut it back from 6 months to 3 months? I have reference not to the research, but the operating end.

Mr. FIELDS. If the program continues we would be requesting the additional appropriation next year for expenditures in this period.

Mr. BOLAND. That is right, but you would not be requesting it this year.

Mr. FIELDS. It might be troublesome in certain areas. I would have to take a look at it and discuss it with the contractors to determine their reaction before I could tell you.

Mr. BOLAND. On the basis of experience at the AEC and the contacts the contractors have had with the Congress, they would be delighted to do it. Whatever you have asked in this program, as you have indicated, the Congress has given you every dime.

Mr. FIELDS. I did not intend to indicate exactly that.

Mr. BOLAND. Almost, in this area.

Mr. FIELDS. I believe that is true. I would have to check that.

Mr. BOLAND. It would be nice to get a little help in cutting $157 million, which is substantial, and it would show that AEC is as interested as we are in cutting the size of the budget to more proportional standards.

REPLACEMENT OF BUSES

You are going to increase the buses from 31 to 85, according to your statement, so would you please indicate why that is necessary? That is on page 239.

Mr. MCCARTHY. These are all replacements, Mr. Chairman. Actually, if you look at the table on page 240, you will notice we are going to reduce the bus fleet by three. These are replacement vehicles which are required to replace some of the older vehicles we now have. It is part of our replacement program.

Mr. JENSEN. You mean you are replacing 85 this year, and you only replaced 31 last year?

Mr. MCCARTHY. That is correct, sir.

Mr. JENSEN. You are asking for no new buses?

Mr. MCCARTHY. That is correct. We are reducing the fleet by three.

Mr. BOLAND. Where do you use the buses, and what for?

Mr. MCCARTHY. The buses are in a number of our installations. We have them in the communities at Oak Ridge and Hanford. They are used also in carrying workers from the town at Hanford to the various work sites. We use them at Idaho to go from Idaho Falls to the site, some 65 miles to the national reactor test station. I believe these are the three major areas. We have a few buses at Savannah River. They are, however, used at most of the various facilities.

Mr. BOLAND. As the communities are incorporating, you no longer supply the buses for those areas?

Mr. MCCARTHY. That is correct.

Mr. FIELDS. They have not been incorporated yet.

Mr. BOLAND. Some of them are going to be incorporated?

Mr. FIELDS. Yes, but it would not be in fiscal 1958.

Mr. BOLAND. Will it be in fiscal 1959?

Mr. FIELDS. Possibly near the end of fiscal 1959, but I doubt it. I think it will be more like fiscal 1960.

Mr. BOLAND. The buses you have now you could not hold for a couple of more years? Why buy new ones now if you can keep the old ones and when the communities are incorporated there is not any necessity for them.

Mr. STRAUSS. These buses serve very remote plants. In Hanford the piles are strung along the Columbia River for miles. They are separated by miles for safety purposes. Oak Ridge is a reservation of great extent in which the plants are separated by a range of Ten-

nessee mountains and strung along valleys. The same thing is true at Savannah River.

Mr. FIELDS. The community buses at Hanford have been eliminated.

Mr. BOLAND. Are there any questions?

REVENUES FROM BUS OPERATIONS

Mr. JENSEN. Yes, Mr. Chairman. Do you derive any revenue from the passengers on these buses?

Mr. FIELDS. There is a payment by the employee normally for bus rides.

Mr. JENSEN. How is that paid?

Mr. FIELDS. It varies with the place. I don't have the figures right here. We can supply the figures as to the charge that is made as against the actual cost of operation.

Mr. JENSEN. Does the revenue generally speaking pay the cost for the upkeep of the buses?

Mr. FIELDS. I don't believe so, sir.

Mr. JENSEN. How many buses do you have altogether?

Mr. MCCARTHY. There are 433 at the present time, and we estimate that 430 buses will be in operation at the end of 1958.

Mr. JENSEN. It is reasonable to expect that those buses would at least pay their own way. Do you have the amount by which your buses are subsidized?

Mr. MCCARTHY. At Hanford, where we have the more costly operation because there we operate the buses from the downtown section out to the plants which are in very remote areas, in 1958 the cost of our bus operations would be $2,900,000. We will secure revenues of roughly $661,000, resulting in $2,239,000 as the net cost of the operation of the buses.

In the community at Oak Ridge the fare is 15 cents or one token. Two tokens sell for 25 cents.

Mr. JENSEN. For how long a ride?

Mr. MCCARTHY. The routes there average from 5 to 15 miles. They operate 7 routes, and there are roughly 19 buses in operation. That is in the community portion of Oak Ridge. For the transportation of workers to the plants, there are 19 buses in operation, and they run 3 routes to the major plants. Here the mileage in terms of distance involved runs from roughly 6 to 21 miles. For this purpose the fare is 30 cents or a token which can be purchased for 25 cents.

Mr. JENSEN. After the town of Richland is sold and becomes an incorporated town, would there be any saving in this bus transportation program, or will it remain the same?

Mr. MCCARTHY. The major cost at Richland is the operation from the town to the plants. Here they have 88 buses in operation. They have some 16 routes and the mileage runs from 4 to 35 miles. Here they charge a 5-cent fare to the worker.

Mr. JENSEN. My question is: Are we going to make a little saving in transportation cost or aren't we after the town has been incorporated?

Mr. MCCARTHY. When the towns are incorporated and have their own transportation, there will be some saving in the bus operation.

Mr. JENSEN. Comparatively speaking, it is a small item, but it ap-

peals to me that those folks should at least pay the cost of operating those buslines.

Mr. FIELDS. Most of the bus operations are not just for the communities, but operate from the communities to the outlying sites which in many instances are great distances, as at Hanford.

Mr. JENSEN. Yes, I have been at Hanford. I know the distances there are even long within the Atomic Energy operation. The Frying Pan, they call it. I will say this: they could not have found a better place to build an atomic-energy plant than that particular place. When we were out there the man who selected the site took us on a tour and told us why he selected the site. I remember I said at the time, if you traveled all over the world you could not find a site more adaptable to this kind of installation.

Mr. FIELDS. It was a good selection, sir.

Mr. JENSEN. It certainly was. That is all, Mr. Chairman.

Mr. BOLAND. Mr. Taber.

GOODS AND SERVICES ON ORDER

Mr. TABER. You show on page 221 an increase of $234 million for goods and services on order. That is about a third of the amount of the new appropriation, if you get it. Isn't that a pretty good figure?

Mr. FIELDS. Yes, sir, it is a large figure. It is a reflection of the increases in this budget for the increased level of operation necessitated by the major programs.

Mr. TABER. What did you spend in 1957?

Mr. FIELDS. Total expenditures, sir?

Mr. TABER. Yes.

Mr. MCCARTHY. The total expenditures for AEC were about $1,990 million.

Mr. TABER. How about for this particular item?

Mr. MCCARTHY. We obligated the full amounts as shown here. We do not have our final reports, but as you see in the 1957 column, $599 million represents the amount on our books for goods and services on order at the end of 1957. This included amounts for the financing arrangement we were just discussing, namely, the 3- and 6-month carryover amounts for this fiscal year, which were obligated under our major contracts.

Mr. TABER. That is all I have.

REACTOR DEVELOPMENT PROGRAM

Mr. BOLAND. We will insert pages 55 through 99 at this point.

(The matter referred to follows:)

REACTOR DEVELOPMENT PROGRAM, OPERATING COSTS

Program statement

Estimate fiscal year 1958	$354,275,000
Estimate fiscal year 1957	264,713,000
Increase	89,562,000

The reactor-development program includes the development of economically feasible nuclear powerplants for civilian power and commercial ship application,

the development of reactors and reactor systems to meet a wide range of military requirements, a program to increase the knowledge on reactor systems and technology and to evaluate advanced reactor concepts, and the operation of the NRTS in Idaho including its technical facilities.

The Commission's civilian power program provides a foundation of technical knowledge through the development, design, assembly, and operation of experimental power reactors. It also provides for cooperative arrangements with industry in the construction of prototype power reactors to establish a basis for transition to a privately financed nuclear power industry. In the AEC development program three reactor experiments are being operated in fiscal year 1957. In current planning, it is expected that these experiments will continue in operation in fiscal year 1958 and will be joined by five additional experimental facilities. In fiscal year 1956, the Commission initiated a program of inviting industry to participate with the Commission in the cooperative development of competitive nuclear power, which was continued through fiscal year 1957. Ten proposals were received by the Commission in fiscal year 1956 and 1957, and development work in support of several of these projects is being initiated in fiscal year 1957 and will continue through fiscal year 1958. The Commission has taken steps in fiscal year 1957 to augment this program by inviting proposals from industrial groups to undertake the construction of additional demonstration reactors.

The Commission's program for fiscal year 1958 includes work on the first nuclear-powered merchant ship and continuation of work currently being carried on in fiscal year 1957 to develop economically competitive nuclear powerplants for use in commercial vessels.

The reactor-development program for military uses has many facets, ranging from the development of reactors for the propulsion of submarines and surface vessels, to military aircraft, and to package mobile plants for the generation of heat and power at remote military locations. The requirements and time schedule for the military reactor-development program have been established by the Department of Defense. Many of the advances developed in the military part of the Commission's reactor-development program contribute significantly to the civilian power program.

All reactor projects require broad reactor engineering-development effort; hence there is also provision in the Commission's program for materials studies, studies of moderators and control techniques, development of fuel elements, studies of chemical processing systems, and, perhaps most important, studies on reactor safety. This work is projected in fiscal year 1958 at a level adequate to meet the requirements of the combined civilian and military reactor programs.

The total program budget for fiscal year 1958 provides for an increase over fiscal year 1957 of $89,562,000.

Summary of estimates by category

	Actual fiscal year 1956	Estimate, fiscal year 1957	Estimate, fiscal year 1958
1. Civilian power reactors	$42,267,127	$53,775,000	$96,775,000
(*a*) Government program	42,267,127	51,781,000	82,849,000
(*b*) Cooperative arrangements program	0	1,994,000	13,926,000
2. Army power reactors	924,763	2,457,000	5,600,000
3. Naval propulsion reactors	40,821,589	66,300,000	84,000,000
4. Aircraft propulsion reactors	49,604,202	85,543,000	91,000,000
5. Merchant ship reactors	57,945	664,000	3,300,000
6. Controlled thermonuclear project (project Sherwood)	6,639,388	11,000,000	21,700,000
7. Advanced engineering and development	7,337,974	9,252,000	6,000,000
8. Reactor safety	1,432,241	3,409,000	11,300,000
9. Separations systems development	6,024,632	9,018,000	10,000,000
10. Operational services	5,411,049	5,772,000	7,100,000
11. Equipment not included in construction projects	10,709,033	17,523,000	17,500,000
Total reactor development program	171,229,943	264,713,000	354,275,000

JUSTIFICATION BY CATEGORIES

1. Civilian power reactors, $96,775,000

The Commission's civilian power-reactor program recognizes that the expeditious development of economically competitive nuclear power is an important national objective. It seeks to accomplish this objective in a manner which will minimize expenditures of Government funds, yet must provide for maintaining world leadership in nuclear-reactor technology. The program was conceived as and continues to be designed for (*a*) an AEC development program to provide a foundation of technical knowledge through the feasibility study, design, component development, assembly, and operation of power-reactor experiments; and (*b*) cooperative arrangements with industry to encourage industrial participation in the construction of prototype-power reactors, thus establishing the basis for transition to a privately financed nuclear-power industry.

	Actual, fiscal year 1956	Estimated, fiscal year 1957	Estimated, fiscal year 1958
(*a*) Government program:			
Pressurized water reactor	$15,225,806	$14,600,000	$21,000,000
Boiling water reactor	4,711,466	5,000,000	5,000,000
Homogeneous reactor	10,694,236	10,700,000	11,800,000
Fast power breeder reactor	4,656,979	6,354,000	13,600,000
Sodium graphite reactor	4,961,304	6,082,000	7,949,000
Liquid metal fuel reactor	1,601,411	3,500,000	8,000,000
Organic moderator reactor	348,779	3,616,000	5,500,000
Plutonium recycle development	0	1,000,000	4,000,000
Pressurized heavy water development	0	500,000	4,000,000
Power reactor advanced design	67,146	429,000	2,000,000
Subtotal	42,267,127	51,781,000	82,849,000
(*b*) Cooperative arrangements program:			
Yanke Atomic Electric Co	0	1,500,000	2,000,000
Power Reactor Development Co	0	244,000	1,500,000
Consumers' Public Power District	0	0	3,151,000
Rural Cooperative Power Association	0	0	700,000
Wolverine Electrical Cooperative	0	0	600,000
City of Piqua, Ohio	0	0	1,500,000
Chugach Electrical Association	0	250,000	1,475,000
Third Invitation	0	0	3,000,000
Subtotal	0	1,994,000	13,926,000
Total	42,267,127	53,775,000	96,775,000

(*a*) *Government program.*—Three power reactor experiments are being operated in fiscal year 1957. These include boiling water reactor experiment (BWRE), sodium reactor experiment (SRE), both of which are being operated for the first time, and the Borax which is being modified and restarted. These experiments are expected to continue in operation during fiscal year 1958 and will be joined by the pressurized water reactor (PWR), homogeneous reactor experiment II (HRE–II), organic moderator reactor experiment (OMRE), and Los Alamos power reactor experiment II (LAPRE–II), and the refabricated experimental breeder reactor–I (EBR–I). A number of additional experiments of experimental facilities will be in advanced design, fabrication, or construction phases in fiscal year 1958. These include Argonne boiling reactor (ARBOR), experimental breeder reactor II (EBR–II), liquid metal fuel reactor experiment (LMFRE), and Los Alamos molten plutonium reactor experiments (LAMPRE–I and LAMPRE–II). Reactor experimentation fabrication costs shown in the following program are for experiments involving less than 10,000 kilowatts of heat.

(1) Pressurized water reactor:

Fiscal year 1957	$14,600,000
Fiscal year 1958	21,000,000

The pressurized water reactor project was started in fiscal year 1954 in order to permit a major advance toward realizing civilian nuclear power. This will be the first United States full-scale nuclear central station powerplant. It is

being built on the Ohio River at Shippingport, Pa., 25 miles from Pittsburgh. Westinghouse Electric Corp. is the Commission's principal contractor for the design, development, and construction of the reactor portion of the plant. Duquesne Light Co., of Pittsburgh, is participating in this project and making contributions which include furnishing a site for the entire project, building the turbine-generator portion of the plant, operating the entire plant, and assuming $5 million of the construction cost for the reactor portion of the plant. Duquesne will be reimbursed for the cost of operating the nuclear portion of the plant, except for the cost of the first 100 persons of the operating crew.

Operation of the PWR plant is scheduled to commence during the first part of fiscal year 1958. Test and operational data taken at Shippingport will be analyzed on a continuing basis and system modifications undertaken where necessary. Replacement components, as required, will be designed, procured, and tested.

Fabrication of the second seed for core 1 will be in progress. The reference design of core 2 will be largely completed, including thermal performance evaluation, and detailed design and manufacturing drawings will be started. The physics mockup critical will be completed and the flux mapping program started. Fabrication of the closure head for core 2 will be continued. Core 2 fuel element development will continue and manufacturing initiated. In-pile tests will be started for the proof tests of core 2 fuel elements. Efforts will continue on alternate control rod materials. Evaluation of the fuel element fission product release behavior under plant conditions will be undertaken. Simulator analysis of plant performance with core 2 will be continued, and the initial tests of components required for plant modifications will be started.

The major elements comprising the cost estimates are:

	Fiscal year 1957	Fiscal year 1958
Research and development on initial core and reactor system	$8,600,000	$3,000,000
Research and development on future cores	5,000,000	7,000,000
Fuel fabrication (replacement cores)	1,000,000	8,500,000
Test operations	0	2,500,000
Total	14,600,000	21,000,000

(2) Boiling water reactor:

Fiscal year 1957	$5,000,000
Fiscal year 1958	5,000,000

The boiling water reactor experiment, a 20 megawatt heat, 5 megawatt electricity plant, was completed at the Argonne National Laboratory in mid-fiscal year 1957. Initial operation was undertaken with natural circulation of the light water coolant moderator. This plant will continue in operation in fiscal year 1958. Modifications in fiscal year 1958 will include installation of a forced circulation system to enhance reactor specific power, and a second core for use in conjunction with heavy water.

The Borax IV was operated in fiscal year 1957 at Idaho using a thorium oxide-enriched uranium oxide core. This is the modified Borax III unit. The plant will continue in operation for at least part of fiscal year 1958 to permit investigation of a new uranium oxide loading. Considerable research and development effort will be devoted to the analysis and evaluation of test results.

Research and development of improved fuels, methods for minimizing radioactive steam carryover, boiling heat transfer, control, and safety will continue in fiscal year 1958, both on a laboratory scale and through the utilization of the boiling water reactor experiment and Borax facilities.

Construction of the Argonne boiling reactor (Arbor) facility at Idaho is being initiated in fiscal year 1958. This is a flexible boiling reactor facility designed to permit determination of the optimum design of boiling water reactor plants. The characteristics of the various proposed cycles, including direct boiling and indirect boiling, will be investigated under varying core size and geometry, steam pressure, and specific power.

The major elements comprising the cost estimates are:

	Fiscal year 1957	Fiscal year 1958
Research and development, boiling water reactor	$2,668,000	$3,516,000
Fuel fabrication:		
Boiling water reactor experiment (BWRE)	327,000	140,000
Argonne boiling reactor (Arbor)	0	660,000
Total fuel fabrication	327,000	800,000
Test operations:		
Boiling reactor experiment (Borax)	102,000	140,000
Boiling water reactor experiment (BWRE)	334,000	280,000
Total test operations	436,000	420,000
Reactor experiment fabrication:		
Boiling reactor experiment (Borax)	186,000	264,000
Boiling water reactor experiment (BWRE)	1,383,000	0
Total reactor experiment fabrication	1,569,000	264,000
Grand total, boiling water reactor	5,000,000	5,000,000

(3) Homogeneous reactor:

Fiscal year 1957	$10,700,000
Fiscal year 1958	11,800,000

The object of this activity is to develop the homogeneous reactor concept taking advantage of its desirable features of inherent nuclear stability without control rods, its adaptability for continuous chemical processing, and its capability for a favorable breeding gain. The main effort is centered at Oak Ridge National Laboratory where it is directed toward the development of a thorium power breeder system. Homogeneous reactor experiment No. 1, thermal output 1,000 kilowatts, was fabricated during 1950 to 1952 and was operated during 1952 to 1954. Following its dismantling, the fabrication of homogeneous reactor experiment No. 2, thermal output of 5,000 kilowatts, was initiated at the same site and completed late in April 1956. Following preoperational testing and breaking-in runs, mechanical difficulties resulting from corrosion caused a delay in reactor startup. Criticality and full power operation are scheduled for the second quarter of fiscal year 1958 with fully enriched uranyl sulfate in the core region and heavy water in the blanket region in order to demonstrate reliability, ease of maintenance, and continuous removal of fission products from the fuel solution. Additional runs planned for late fiscal year 1958 and early fiscal year 1959 will include depleted uranyl sulfate solution in the blanket in order to accumulate data and experience in the operation, maintenance, and processing of the active blanket system. To best meet the long-range objectives of the project, it is planned that the dual region slurry concept, engineering development, and chemical processing programs will be accelerated and broadened during fiscal year 1958.

Supplementary homogeneous reactor experiments will continue at the Los Alamos Scientific Laboratory through fiscal year 1958 using uranyl phosphate rather than sulfate, as fuel. Los Alamos power reactor experiment No. 1, thermal output of 2,000 kilowatts, employing forced circulation was completed during fiscal year 1957 and operated for a short period. Due to excessive corrosion in the heat exchanger, the experiment had to be shut down and all further work was discontinued on this experiment. Los Alamos power reactor experiment No. 2, thermal output, 1,000 kilowatts, using natural convection for circulation will be completed in fiscal year 1958. It is planned to continue operation of this experiment during fiscal year 1958 to observe long-time operation as a prototype for low-power applications in remote areas.

The major elements comprising the cost estimates are:

	Fiscal year 1957	Fiscal year 1958
Uranyl sulfate approach:		
Research and development, homogeneous reactor experiment (HRE)	$8,500,000	$10,220,000
Test operations (HRE)	1,000,000	1,500,000
Reactor fabrication (HRE)	500,000	0
Total, uranyl sulfate approach	10,000,000	11,720,000
Uranyl phosphate approach: Research and development, Los Alamos power reactor experiment (LAPRE)	700,000	80,000
Grand total, homogeneous reactor	10,700,000	11,800,000

(4) Fast power breeder reactor:

Fiscal year 1957 ..... $6,354,000
Fiscal year 1958 13,600,000

The objectives of this program are the development of fast power breeder reactors using solid and molten fuels. Work on the solid fuel approach is centered at Argonne National Laboratory and the molten fuel work is underway at Los Alamos Scientific Laboratory.

The Argonne National Laboratory work is being directed toward the construction and operation of a prototype fast reactor, EBR–2, having a 62.5 megawatts thermal output and about 20 megawatts gross electrical output. Construction will begin at the National Reactor Testing Station in fiscal year 1958. Reactor operations are scheduled for fiscal year 1960.

A comprehensive research and engineering development effort, supporting the construction of EBR–2 has been initiated and will continue through fiscal year 1958. Full-size sodium pumps, valves, and fuel-handling equipment have been built and are now under test to determine component reliability, efficiency, and operating characteristics. Exponential and zero power assembly determinations have been partially completed in order to determine approximate critical mass of EBR–2, effectiveness of control rods, and spatial neutron energy distribution. Numerous theoretical studies are being conducted to increase understanding of nuclear instabilities observed in the EBR–I and possible effect on fuel element bowing. The EBR–1 refabricated in fiscal year 1957 will be operated in fiscal year 1958 for this purpose. Fabrication and testing of plutonium alloys for reactor use will continue.

The Los Alamos Scientific Laboratory is conducting research and development for the design, construction, and operation of a plutonium fast reactor experiment (LAMPRE–I). The elimination of solid fuel elements offers the prospect for simpler construction, ease of chemical reprocessing, and attainment of higher fuel burnup. The major problem associated with this system is containment of the high temperature molten fuel alloy and demonstration of nuclear stability.

Based upon successful irradiation-corrosion tests in the MTR, LAMPRE–I should be ready for operation in fiscal year 1959. Following LAMPRE–I will be a larger engineering model, LAMPRE–II having a thermal output of 10 megawatts heat. A power-producing prototype having about 15 megawatts electrical output, designated LAMPRE–III, is expected to operate in the period fiscal years 1961–64, depending upon success of LAMPRE–I and LAMPRE–II experiments.

The major elements comprising the cost estimates are:

	Fiscal year 1957	Fiscal year 1958
Solid fuel approach:		
Research and development, experimental breeder reactor (EBR)	$4,031,000	$8,342,000
Fuel fabrication, experimental breeder reactor II	0	800,000
Test operations (EBR–I)	259,000	558,000
Reactor experiment fabrication (EBR–I modification)	564,000	0
Total, solid fuel approach	4,854,000	9,700,000
Molten fuel approach:		
Research and development, Los Alamos molten plutonium reactor experiment (LAMPRE)	1,500,000	2,900,000
Reactor experiment fabrication (LAMPRE–I)	0	1,000,000
Total, molten fuel approach	1,500,000	3,900,000
Grand total, fast power breeder reactor	6,354,000	13,600,000

(5) Sodium graphite reactor:

Fiscal year 1957	$6,082,000
Fiscal year 1958	7,949,000

The sodium reactor experiment (SRE) was completed by North American Aviation at Santa Susana, Calif., in the last quarter of fiscal year 1957. Operation of the reactor followed, with full power operation of 20 microwatts scheduled during fiscal year 1958. The purpose of the project is to develop the technology of sodium graphite reactors and to improve components of the reactor system as experience is gained through operation of the reactor.

Design studies and development work was initiated on a second core for the SRE during the second half of fiscal year 1957. The second core will be fabricated and installed late in fiscal year 1958 or early fiscal year 1959, and will contain a totally new fuel loading, and a new graphite configuration. The development and fabrication of the core components, and other sodium-graphite technology development work will continue through fiscal year 1958.

During fiscal year 1957, the Southern California Edison Co. and North American Aviation entered into a contract in which Southern California Edison will purchase the SRE heat for conversion into electrical power. The necessary electrical generators and transmission systems were installed at a cost of $1,100,000, borne entirely by the Southern California Edison Co. It is expected that the electrical power will be transmitted into the Southern California Edison system during the early part of fiscal year 1958.

The major elements comprising the cost estimates are:

	Fiscal year 1957	Fiscal year 1958
Research and development	$4,460,000	$6,628,000
Fuel fabrication	14,000	300,000
Test operations	108,000	1,021,000
Reactor experiment fabrication and modification	1,662,000	0
Gross cost	6,244,000	7,949,000
Less NAA share of cost	162,000	0
Net cost to AEC	6,082,000	7,949,000

(6) Liquid metal fuel reactor:

Fiscal year 1957	$3,500,000
Fiscal year 1958	8,000,000

Extensive component development studies carried out by Brookhaven National Laboratory prior to fiscal year 1956 indicated that liquid metal fuel systems are feasible and have possibilities of achieving low-cost power. On the basis of the results of these studies, and expanded program was initiated in fiscal year 1956. A new major contractor, Babcock & Wilcox Co. entered the power reactor program to design, fabricate, assemble and operate a liquid metal fuel reactor experiment.

Activities by the Babcock & Wilcox Co. during fiscal year 1958 will be directed to completing detailed design of the reactor design recommended to the AEC during fiscal year 1957. It is expected that fabrication will begin very early in the year with completion scheduled for fiscal year 1959 or fiscal year 1960. At the same time, research and development activities will include extensive testing and development of the components to be used in the reactor.

Brookhaven's activities will continue supporting development work in connection with the liquid metal fuel reactor experiment, and more basic work on alternate liquid metal fuel concepts. Work in support of the experiment will be concerned with basic studies of the chemical processing techniques which can be applied to the LMFR concept, physics studies defining the conditions under which breeding can be obtained, and chemical engineering and metallurgical work on the blanket for the experiment. Emphasis will also be placed on other fissionable material fuel solutions to determine potentially attractive systems for future development.

The major elements comprising the cost estimates are:

	Fiscal year 1957	Fiscal year 1958
Research and development	$3,500,000	$8,000,000

(7) Organic moderator reactor:

Fiscal year 1957 ..... $3,616,000
Fiscal year 1958 5,500,000

The organic moderator reactor experiment, 16 MW heat, was completed by North American Aviation at the National Reactor Testing Station, Idaho, in fiscal year 1957, and operation of the reactor is expected to start early in fiscal year 1958. It is the purpose of the experiment to establish the basic feasibility of using organic fluids as reactor moderators and coolants. Experimental studies are being made to determine the extent to which the hydrocarbon remains adequately stable under various reactor operating conditions, the rates of organic replacement or purification rates necessary for satisfactory performance, and material requirements for reactor components.

In addition to fabrication and operation of the organic experiment, core design studies, and development work were initiated in fiscal year 1957 on a larger scale, advanced reactor. This work includes heat-transfer and fluid-flow studies under conditions simulating various regions of the reactor, development of materials required for reactor core and fuel element fabrication, development of reactor components and handling techniques, and fabrication of a critical facility for studies on the reactor flux distribution characteristics.

The major elements comprising the cost estimates are:

	Fiscal year 1957	Fiscal year 1958
Research and development	$1,744,000	$4,750,000
Fuel fabrication, OMRE	306,000	100,000
Test operations, OMRE	91,000	650,000
Reactor experiment fabrication, OMRE	1,872,000	----------
Gross cost	4,013,000	5,500,000
Less: NAA's share of cost	397,000	----------
Total	3,616,000	5,500,000

(8) Plutonium recycle development:

Fiscal year 1957 ..... $1,000,000
Fiscal year 1958 4,000,000

The purpose of this project is to demonstrate the feasibility of recycling plutonium in thermal reactors. This mode of operation will permit the operation of power reactors without continuing dependence on a supply of enriched uranium; at the same time, the performance of these reactors may approach that obtained with enriched uranium loadings. Plutonium recycling is expected to be of particular importance to many foreign countries, but it is also quite possible that the use of plutonium in this manner may be attractive in this country as well.

Experimental fuel elements are expected to be fabricated late in fiscal year 1958 for irradiation testing. Advanced development work on chemical separations methods, reactor physics, and plutonium and natural uranium fuel-element design will be accelerated.

(9) Pressurized heavy-water development:

Fiscal year 1957 ..... $500,000
Fiscal year 1958 4,000,000

This development project was initiated in fiscal year 1957 to meet the increasing demand for a power reactor utilizing natural uranium as fuel. A heavy-water moderated and cooled reactor offers the best immediate promise to meet this requirement.

The work contemplated for fiscal year 1958 includes continuation of reactor design work as necessary to guide the development program, development of low-cost long-life natural uranium fuel elements, experimental and theoretical physics, and heat-transfer work to determine optimum-core configuration. A principal item of development will be the design of the pressure vessel, since present methods of pressure-vessel construction impose a maximum size limit, which in turn limits the maximum power capacity of this type of reactor. Alternate design involving pressurized tubes will be investigated. Development work to modify components developed for light waterpower reactors will be carried out as required to meet the increased necessity for leak-tightness in heavy-water systems.

(10) Power reactor advanced design:

Fiscal year 1957	$429,000
Fiscal year 1958	2,000,000

Work in this category consists of (1) advanced design and preliminary development work on new reactor concepts in order to establish sufficient technical information on which a decision to proceed with a reactor experiment can be based, and (2) studies and evaluations of more general applicability to the reactor development program.

During fiscal year 1957, work was initiated on the flowable solids reactor.

During fiscal year 1958 evaluation studies being started during fiscal year 1957 will be continued, and new concept evaluations, such as the plutonium oxide fast breeder and sodium-slurry reactor, will be initiated. General studies will also be initiated, including the long-term effect of U–236 buildup in enriched uranium reactors.

(b) *Cooperative arrangement program: Fiscal year 1957, $1,944,000; fiscal year 1958, $13,926,000.*—The Atomic Energy Act of 1954 declares as a national policy that the development, use, and control of atomic energy shall be directed so as to strengthen free competition in private enterprise. A stated purpose of the act provides for a program to encourage widespread participation in the development and utilization of atomic energy for peaceful purposes. The cooperative arrangements program, accordingly, has as its objective the stimulation of industrial participation in the development and application of nuclear technology to the generation of power for civilian use and to bring to bear management incentives for cost reductions in these demonstration projects.

The first-round invitation was for the purpose of opening the way for American industry to develop, fabricate, construct, and operate experimental nuclear power reactors by bringing private resources into the development of engineering information on the performance of such reactors. As a result of this invitation, proposals were received from four utility companies. Contracts have been concluded for two of the proposals and negotiations are underway on the third. The fourth proposal involved no Federal assistance.

The objective of the second round was to bring additional resources into the development, design, and construction of smaller reactors ranging from 5,000 to 40,000 kilowatts of electricity. The aim was to accelerate the development of reactors of a size which would be of benefit to domestic users in certain areas and would be suitable for use in foreign countries. Pursuant to this invitation, the Commission received 7 proposals of which 4 are now considered as being acceptable for purposes of negotiation. Three proposals were rejected.

In order to get on with the construction of additional types of reactors, the Commission on January 7, 1957, issued a third invitation for proposals from industry. No limitation was placed on the type or size of reactors except that they should make a significant contribution toward achievement of commercial utilization of nuclear power. To date the Commission has received and is reviewing two proposals. Indications are that additional proposals will be received.

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Under section 261a (2), as recently amended, it is expected that the Congress will enact an authorization bill for fiscal year 1958 which would provide for an authorization of appropriation for the cooperative arrangements program in the amount of $133 million and would authorize waiver of fuel-use charges currently estimated at $23 million. Prior to the passage of the fiscal year 1958 authorization act, the Commission during fiscal year 1957 made contracts with Yankee Atomic Electric Co., Power Reactor Development Co., and Nuclear Development Association (for research and development applicable to the Chugach Electric Association proposal), the amounts for which were not included in the new authorization because they were previously obligated, except for appropriation amounts required subsequent to fiscal year 1957.

In summary, operating funds included in the fiscal year 1958 budget estimates for the cooperative arrangements program are as follows:

Operating costs	$13,926,000
Change in undelivered orders	[1] 54,700,000
Total	68,626,000

[1] Includes $11,000,000 for postconstruction research-and-development and operating expenses.

The following table represents in detail the funding requirements for the cooperative arrangements program, setting forth the arangements included in the fiscal year 1958 authorization and those previously entered into:

Cooperative arrangements program

[In thousands]

	Program authorized in new bill					Program previously obligated			Summary of total program			
	Estimate of cooperative programs included in new bill	Less: Estimate for waiver of fuel usages	Total appropriation authorized	Estimate for reactor construction [1]	Total research and development [2]	Estimate of cooperative programs previously approved	Less: Estimate for waiver of fuel-use charges	Total appropriation obligated	Estimate of cooperative programs	Estimate of waiver of fuel-use charges	Estimate of reactor construction [1]	Estimate of reserve and development
1st-round invitation:												
Yankee Atomic Electric Co.	0	0	0	0	0	$7,980	$2,980	$5,000	$7,980	$2,980	0	$5,000
Power Reactor Development Co.	$4,206	0	$4,206	0	$4,206	3,947	3,703	244	8,153	3,703	0	4,450
Consumers Public Power District	51,503	$1,325	50,178	[3] $24,013	26,165	0	0	0	51,503	1,325	[3] $24,013	26,165
Total, 1st round	55,709	1,325	54,384	24,013	30,371	11,927	6,683	5,244	67,636	8,008	24,013	35,615
2d round invitation:												
Rural Cooperative Power Association	8,571	125	8,446	[4] 5,686	2,760	0	0	0	8,571	125	[4] 5,686	2,760
Wolverine Electric Cooperative Association	5,472	0	5,472	[4] 3,837	1,635	0	0	0	5,472	0	[4] 3,837	1,635
City of Piqua, Ohio	8,135	625	7,510	[4] 4,010	3,500	0	0	0	8,135	625	[4] 4,010	3,500
Chugach Electric Association	16,429	620	15,809	[5] 6,729	9,080	800	0	800	17,229	620	[5] 6,729	9,880
Post construction research and development and operating expense	11,000	0	11,000	0	11,000	0	0	0	11,000	0	0	11,000
Total, 2d round	49,607	1,370	48,237	20,262	27,975	800	0	800	50,407	1,370	20,262	28,775
3d round invitation	50,000	20,000	30,000	0	30,000	0	0	0	50,000	20,000	0	30,000
Total, cooperative arrangements	155,316	22,695	132,621	44,275	88,346	12,727	6,683	6,044	168,043	29,378	44,275	94,390

[1] Funded out of plant acquisition and construction appropriation.

[2] The amount set forth under this heading includes all amounts to be funded from the appropriation "Operating expense, Atomic Energy Commission," and includes preconstruction research and development, postconstruction research and development, and operating expenses.

[3] Previously included under project 56–b–1, authorized in Public Law 141, 84th Cong.

[4] Previously included under project 57–c–10, authorized in Public Law 981, 84th Cong.

[5] $750,000 of this amount previously included under project 57–c–10, authorized in Public Law, 84th Cong.

} Total previously authorized, $38,296,000.

The various cooperative arrangements noted in the above table together with funds requested for each follows:

(1) Yankee Atomic Electric Co.:

Fiscal year 1957	$1,500,000
Fiscal year 1958	2,000,000

In response to the first invitation under this program, the Yankee Atomic Electric Co. submitted a proposal for the construction of an advanced pressurized water reactor to be located in the State of Massachusetts. The objective of this project is to conduct research and development on an advanced pressurized water reactor of about 134,000 kilowatt electrical output. This work will consist primarily of fuel element development, component development, criticality experiments, and irradiation studies. It is assumed that other related development work proceeds in accordance with current program projections. The following project specifications represent some contemplated design objectives and are therefore approximate: heat output, 480,000 kilowatts; electrical output, 134,000 kilowatts (nominal); moderator, H_2O; coolant, H_2O; estimated date of completion, 1960; total estimated plant cost, $32,500,000 (does not include fuel fabrication costs or general and administrative outlay).

The AEC will provide research and development assistance in Commission facilities up to a maximum cost to AEC of $1 million, and will bear the cost of research and development work in private facilities up to a maximum of $4 million. It is contemplated that the work to be conducted in AEC facilities will consist of criticality and radiation damage experiments, and that to be done in private facilities will include fuel element and component development.

[In thousands]

Research and development	Total	Fiscal year 1956	Fiscal year 1957	Fiscal year 1958	Funded in subsequent years
Costs	$5,000	0	$1,500	$2,000	$1,500
Change in undelivered orders		+$5,000	−1,500	−2,000	−1,500
Obligational authority required	5,000	5,000	0	0	0

In addition, the Commission will waive the use charge of special nuclear materials for the period of the contract (5 years after the issuance of the facility license), the value of which is estimated to be $2,980,000.

The Yankee Atomic Electric Co. will design, construct, and operate the entire plant, estimated to cost $32,500,000 for the nuclear and conventional portions.

[In thousands]

Total program	AEC	Contractor	Total cost
Research and development	$5,000	0	$5,000
Waiver of fuel use charge	2,980	0	2,980
Construction	0	$32,500	32,500
Total	7,980	32,500	40,480

(2) Power Reactor Development Co.:

Fiscal year 1957	$244,000
Fiscal year 1958	1,500,000

In response to the first invitation under this program, the Power Reactor Development Co. submitted a proposal for the construction of a fast breeder reactor to be located in the State of Michigan. The objective of this project is to conduct research and development on a fast breeder reactor of about 100,000 kilowatts electrical output. This work will consist primarily of consulting services, critical experiments, material irradiation, and fuel development. It is assumed that other related development work proceeds in accordance with current program projections. The following project specifications represent contemplated design objectives and are therefore approximate: heat output, 300,000 kilowatts;

electrical output, 100,000 kilowatts (nominal); moderator, none; coolant, sodium; estimated date of completion, 1960; total estimated plant cost, $45,225,000 (does not include plant operating costs, research and development, and waiver of fuel use charges).

The AEC will provide research and development assistance in Commission facilities up to a maximum cost to AEC of $4,450,000 (this figure includes $244,000 obligated in fiscal year 1957). It is contemplated that the research and development work will consist primarily of consulting services, critical experiments, material irradiation, and fuel development.

[In thousands]

Research and development	Total	Fiscal year 1957	Fiscal year 1958	Funded in subsequent years
Costs	$4,450	$244	$1,500	$2,706
Change in undelivered orders		0	0	0
Obligational authority required	4,450	244	1,500	2,706

In addition, the Commission would waive the use charge of special nuclear materials for the period of the contract (5 years after the issuance of the facility license); the value of which is estimated to be $3,703,000.

The Power Reactor Development Co. will design, construct, and operate the reactor plant, estimated to cost $31,225,000, and will arrange with the Detroit Edison Co. to build and operate the related turbine-generator plant, estimated to cost $14 million. PRDC will also furnish personnel to assist in the research and development work to be performed in Commission facilities.

[In thousands]

Total program	AEC	Contractor	Total cost
Research and development	$4,450	$9,000	$13,450
Waiver of fuel use charge	3,703	0	3,703
Construction	0	45,225	45,225
Total	8,153	54,225	62,378

(3) Consumers Public Power District:

Fiscal year 1957 0

Fiscal year 1958 ..... $3,151,000

In response to the first invitation under this program, the Consumers Public Power District of Nebraska submitted a proposal for the construction of a sodium-graphite reactor to be located in the State of Nebraska. The objective of this project is to supplement other research and development as necessary to construct, initiate operations, and provide unusual postconstruction maintenance for a large-scale nuclear powerplant using a sodium-graphite reactor. The work consists primarily of component development, engineering testing, and nuclear plant design, and assumes that other related development work proceeds in accordance with current program projections. The following project specifications represent contemplated-design objectives and are therefore approximate: heat output, 245,000 kilowatts; electrical output, 75,000 kilowatts (nominal); moderator, graphite; coolant, sodium; estimated date of completion, mid-1961; total estimated plant cost, $40,583,000 (does not include fuel-fabrication cost, research and development, and fuel-use charges).

The AEC will conduct research and development under contract at no cost to Consumers estimated to cost $18,165,000. It is contemplated that this work will consist primarily of component design, engineering testing, and nuclear-plant design. In addition, the Commission will also provide for postconstruction unusual maintenance and fuel-cycle costs up to a ceiling of $8 million. All terms are tentative subject to further negotiation.

[In thousands]

Research and development	Total	Fiscal year 1957	Fiscal year 1958	Funded in subsequent years
Costs	[1] $26,165	$0	$3,151	[1] $23,014
Change in undelivered orders		0	8,000	−8,000
Obligational authority required	[1] 26,165	0	11,151	[1] 15,014

[1] Includes $8,000,000 for post-construction unusual maintenance and fuel cycle costs.

The AEC, based upon a cost-type contract, will provide $24,013,000 for the cost of the reactor. In addition, the Commission will waive the use charge of special nuclear materials for the period of the contract (from date of contract through the first 5 years of operation), the value of which is estimated to be, subject to adjustment due to changes in core design, $1,325,000. All terms are tentative subject to further negotiation.

The Consumers Public Power District will provide the site for the reactor on a long-term, no-cost lease to the Government, and will provide electrical generating facilities. The total estimated cost of site and facilities to be furnished by the contractor is $11,350,000. In addition, the contractor will support reactor construction to the extent of $5,220,000. All terms are tentative subject to further negotiation.

[In thousands]

Total program	AEC	Contractor	Total cost
Research and development	[1] $26,165	$0	[1] $26,165
Waiver of fuel use charge	1,325	0	1,325
Construction	24,013	16,570	40,583
Total	[1] 51,503	16,570	[1] 68,073

[1] Includes $8,000,000 for post-construction unsuual maintenance and fuel cycle costs.

(4) Rural Cooperative Power Association:

Fiscal year 1957	0
Fiscal year 1958	$700,000

In response to the second invitation under this program, the Rural Cooperative Power Association submitted a proposal for the construction of a boiling water reactor to be located in the State of Minnesota. The objective of this subject is to develop, design, and construct an advanced small capacity boiling water power reactor. The principal research and development work will be directed toward developing and testing an improved reactor core. The reactor will be operated for at least 5 years to conduct research and development aimed at improving its economic and technical characteristics. It is assumed that other related development work proceeds in accordance with current program projections. The following project specifications represent contemplated design objective and are therefore approximate: heat output, 58,000 kilowatts (excludes superheater, 17,000 kilowatts); electrical output, 22,000 kilowatts (nominal; moderator, H_2O; coolant, H_2O; by-product production, none; estimated date of completion, 1959; total estimated plant cost, $8,136,000 (does not include costs of research and development, fuel fabrication, and waiver of fuel use charges).

The AEC will provide research and development assistance in Commission facilities up to an agreed limit of $100,000 and will pay on the cost-basis for research and development work and fuel fabrication up to a maximum of $2,660,000. It is contemplated that this work will be primarily on the fuel elements. All terms are tentative subject to further negotiation.

[In thousands]

Research and development	Total	Fiscal year 1957	Fiscal year 1958	Funded in subsequent years
Costs	$2,760	0	$700	$2,060
Change in undelivered orders		0	+2,060	−2,060
Obligational authority required	2,760	0	2,760	0

The AEC, based upon a cost-type contract, will provide for the cost of the reactor and superheater, which has been established by negotiation at a ceiling of $5,686,000. This does not include $1 million to be expended by AMF Atomics, Inc., toward design, engineering, and construction of the reactor. In addition, the Commission would waive the use charge for special nuclear materials for the period of the contract (from date of contract through the first 5 years of operation of the reactor), the value of which is estimated to be, subject to adjustment due to changes in core design, $125,000. All terms are tentative subject to further negotiation.

RCPA will provide a site for the reactor on a long-term, no-cost lease to the Government (at an estimated value of $700,000), and will provide the electrical generating facilities at an estimated cost of $1,750,000. All terms are tentative subject to further negotiation.

[In thousands]

Total program	AEC	Contractor	Total cost
Research and development	$2,760	[1] $1,000	[1] $3,760
Waiver of fuel use charge	125	0	125
Construction	5,686	2,450	8,136
Total	8,571	[1] 3,450	[1] 12,021

[1] $1,000,000 expended by AMF Atomics, Inc., toward design, engineering, and construction of the reactor.

(5) Wolverine Electric Cooperative Association:

Fiscal year 1957	0
Fiscal year 1958	$600,000

In response to the second invitation under this program, the Wolverine Electric Cooperative Association of Michigan submitted a proposal for the construction of an aqueous homogeneous reactor to be located in the State of Michigan. The objective of this project is to develop, design, and construct a small-capacity homogeneous reactor. The principal preconstruction research and development will be in corrosion-test loops, chemical reprocessing, hydrostatic tests, and primary loop mockup. It is assumed that other related development work proceeds in accordance with current program projections. The following project specifications represent contemplated design objectives and are therefore approximate: Heat output, 26,000 kilowatts (excludes superheater output of 7,000 kilowatts); electrical output, 10,000 kilowatts (nominal); moderator, uranyl sulfate in heavy water; coolant, circulating fuel; byproduct production, none; estimated date of completion, 1961; total estimated plant cost, $4,594,000 (does not include the fuel fabrication and conversion costs, and the research and development costs).

The AEC will pay on a cost basis for research and development work by the reactor manufacturer up to a maximum of $1,635,000. All terms are tentative subject to further negotiation.

[In thousands]

Research and development	Total	Fiscal year 1957	Fiscal year 1958	Funded in subsequent years
Costs	$1,635	0	$600	$1,035
Change in undelivered orders		0	+1,035	−1,035
Obligational authority required	1,635	0	1,635	0

The AEC, based on a fixed-price contract, will provide for the cost of the reactor which is now estimated at $3,837,000. Wolverine will provide a site for the reactor on a long-term no-cost lease to the Government, and will provide the electrical generating facilities at an estimated cost of $757,000. Wolverine has requested the right to terminate at the end of 1 year of operation, if costs of operating a nuclear powerplant exceeds the cost of operating a conventional plant. This condition is still subject to negotiation. All terms are tentative subject to further negotiation.

Wolverine has not specifically requested waiver of use charge for special nuclear materials. The AEC has estimated that the fuel-use charge for a 5-year period would be $250,000.

[In thousands]

Total program	AEC	Contractor	Total cost
Research and development	$1,635	0	$1,635
Waiver of fuel use charge	0	0	0
Construction	3,837	$757	4,594
Total	5,472	757	6,229

(6) City of Piqua:

Fiscal year 1957	0
Fiscal year 1958	$1,500,000

In response to the second invitation under this program, the city of Piqua submitted a proposal for the construction of an organic cooled and moderated reactor to be located at Piqua, Ohio. The objective of this project is to demonstrate and improve operational features of a small capacity nuclear powerplant utilizing the organic cooled and moderated reactor concept. The project provides for the design and construction of a nuclear powerplant with a net electrical output of about 12,500 kilowatts and for 5 years of postoperational research and development with this plant. It is assumed that related development proceeds in accordance with current program projections. The following project specifications represent contemplated design objectives and are therefore approximate: Heat output: 45,500 kilowatts; electrical output: 12,500 kilowatts (nominal); moderator: Terphenyl; coolant: Terphenyl; byproduct production: Undetermined; estimated date of completion: Undetermined; total estimated plant cost: $7,965,000 (does not include costs of research and development, fuel fabrication, and waiver of fuel use charges).

The AEC will provide research and development assistance in Commission facilities currently estimated to cost $3,500,000. It is contemplated that this will include work on reactor design and fuel element concepts. All terms are tentative subject to further negotiation.

[In thousands]

Research and development	Total	Fiscal year 1957	Fiscal year 1958	Funded in subsequent years
Costs	$3,500	0	$1,500	$2,000
Change in undelivered orders		0	0	0
Obligational authority required	3,500	0	1,500	2,000

AEC, based on a fixed-price contract, will provide for the cost of the reactor, now estimated at $4,010,000. In addition, the Commission would waive the use charge of special nuclear materials for the period of the contract (from date of contract through the first 5 years of operation of the reactor), the value of which is estimated to be $625,000 (subject to adjustment due to changes in reactor design). All terms are tentative subject to further negotiation.

The city of Piqua will provide the site and buildings to house the reactor and will provide electrical generating and distribution facilities. The total cost of the site and facilities to be provided is estimated at $3,955,000. All terms are tentative subject to further negotiation.

[In thousands]

Total program	AEC	Contractor	Total cost
Research and development	$3,500	0	$3,500
Waiver of fuel use charge	625	0	625
Construction	4,010	$3,955	7,965
Total	8,135	3,955	12,090

(7) Chugach Electric Association of Alaska:

Fiscal year 1957 ..... $250,000

Fiscal year 1958 1,475,000

In response to the second invitation under this program, the Chugach Electric Association of Alaska submitted a proposal for the construction of a sodium-cooled, heavy-water moderated reactor to be located in Alaska. The objective of this project is to develop, evaluate, and demonstrate the technology applicable to a sodium-cooled, heavy-water moderated power reactor. The project is planned in three phases: (*a*) Preliminary design and development; (*b*) detailed design and construction of a demonstration power reactor; and (*c*) operation of the demonstration power reactor for 5 years. The following project specifications represent contemplated design objectives and are therefore approximate: Heat output, 40,000 kilowatts; electrical output, 10,000 kilowatts (nominal); moderator, heavy water; coolant, liquid sodium; byproduct production, undetermined; estimated date of completion, undetermined; total estimated plant cost, $8,579,000 (does not include costs of fuel fabrication, research and development, and waiver of fuel-use charges).

AEC will conduct research and development work under contract at no cost to Chugach estimated to cost $9,880,000 (includes $800,000 obligated in fiscal year 1957). It is contemplated that this will include work on reactor design concepts and fuel elements. All terms are tentative subject to further negotiation.

[In thousands]

Research and development	Total	Fiscal year 1957	Fiscal year 1958	Funded in subsequent years
Costs	$9,880	$250	$1,475	$8,155
Change in undelivered orders		550	7,605	−8,155
Obligational authority required	9,880	800	9,080	0

The AEC, based on a fixed-price contract, will provide the cost of the reactor, now estimated at $6,729,000. In addition, the Commission would waive the use charge of special nuclear materials for the period of the contract (from date of contract through the first 5 years of operation of the reactor), the value of which is estimated to be $620,000, subject to adjustment due to changes in reactor design. All terms are tentative subject to further negotiation.

The Chugach Electric Association of Alaska will provide a site and building for the reactor on a long-term, no-cost lease to the Government, and will provide electrical generating facilities. The total estimated cost of site and facilities to be furnished by the contractor is $1,850,000. NDA has contributed $25,000 to preconstruction research and development. All terms are tentative subject to further negotiation.

[In thousands]

Total program	AEC	Contractor	Total cost
Research and development	$9,880	$25	$9,905
Waiver of fuel-use charges	620	0	620
Construction	6,729	1,850	8,579
Total	17,229	1,875	19,104

(8) Third invitation:

Fiscal year 1957	0
Fiscal year 1958	$3,000,000

On January 7, 1957, the Commission invited proposals for the development, design, construction, and operation of nuclear powerplants within the United States. The objective is to provide a continuing program of assistance by the Commission to American industry, both private and public, in using its resources for the development of engineering information on the performance of nuclear power reactors and to advance the time when nuclear power will become economically competitive. No limitation has been placed on the type or size of nuclear powerplants which may be proposed except that they should make a significant contribution toward achieving commercial utilization of nuclear power. Proposed plants must be completed by June 30, 1962, except for full-scale plants utilizing fluid fuel-reactor systems which need not be completed until at least June 30, 1963.

In making this invitation, the Commission indicated it would give consideration to the following types of assistance: Waiver of established Commission charges for use of source and special nuclear materials up to an agreed upon amount of money, for a period not greater than 5 years from the issuance of the license to operate the facility, plus lead time required for fabrication; performance in AEC laboratories without charge, or at less than full cost, up to a fixed dollar amount of mutually agreed upon research and development using facilities, personnel, or equipment not reasonably available elsewhere; entering into research and development contracts with the proposal under section 31a of the AEC Act of 1954. The Commission will also consider requests for research and development asistance in connection with reactor operation in recognition of exigencies related to the experimental nature of the project.

In response to this invitation, the Commission has received and is reviewing proposals from Florida Nuclear Power Group and Northern States Power Group. Additional proposals are expected.

The $3 million requested for fiscal year 1958 is the estimated amount required for research and development assistance to contractors for proposals received and accepted under the invitation.

[In thousands]

Research and development	Total	Fiscal year 1957	Fiscal year 1958	Funded in subsequent years
Costs	$30,000	0	$3,000	$27,000
Change in undelivered orders	x x x	0	27,000	−27,000
Obligational authority required	30,000	0	30,000	0

Waiver of fuel use charges under the third-round invitation is currently estimated at $20 million. Total commission assistance under the third round is therefore currently estimated at $50 million.

2. Army power reactors, $5,600,000

The objective of this program is the development of a family of reactor systems to fulfill military requirements for package powerplants for use in remote areas and for uniquely military purposes. To meet this objective, all reactor concepts which show promise of fulfilling military requirements must be studied and evaluated. Three general reactor concepts are under development into military package-power systems: (1) Pressurized water-heterogeneous reactors; (2) boiling-heterogeneous reactors; and (3) gas-cooled reactors. In addition to advanced studies of these types, there will be an intensive study of intermediate and fast reactors in order to derive full military advantage from the compactness such reactors permit.

(*a*) Pressurized water reactor systems:

Fiscal year 1957, $356,000
Fiscal year 1958, $600,000

In fiscal year 1958, efforts on pressurized water systems will include test operation of the Army package-power reactor (APPR–1), a 10 MW (reactor

heat) plant designed to supply power and heat at remote military bases with strengths of 150–300 men. Following completion of the plant in fiscal year 1957, with continuous development of improvements for use in field models, in fiscal year 1958 there will be an extensive zero-power test program on APPR plate-type fuel elements and tubular fuel elements and a concerted effort to improve techniques for the fabrication of control elements.

The major elements comprising the cost estimates are as follows:

	Fiscal year 1957	Fiscal year 1958
Research and development	$186,000	$200,000
Fuel fabrication	170,000	150,000
Test operation	0	250,000
Total	356,000	600,000

(*b*) Boiling heterogeneous reactor systems:

Fiscal year 1957	$434,000
Fiscal year 1958	700,000

In fiscal year 1958, efforts on boiling heterogeneous reactor systems will be directed toward the completion, test operation, and modification of a prototype low power (approximately 2.5 megawatts heat) reactor, known as the Argonne low-power reactor (ALPR), and intended for use in small, remote military installations. Experiments designed to extend core life will continue, as will reactor core-materials evaluations. In addition to critical experiments aimed at improving reflector controls, there will be continuous investigation of possible modifications of the ALPR control system with a view toward increasing simplicity and reliability of operation.

The major elements comprising the cost estimates are as follows:

	Fiscal year 1957	Fiscal year 1958
Research and development	$434,000	$400,000
Fuel fabrication	0	150,000
Test operation	0	150,000
Total	434,000	700,000

(c) Gas-cooled reactor systems:

Fiscal year 1957	$1,311,000
Fiscal year 1958	3,700,000

Following the start of fabrication of a gas-cooled reactor experiment (GCRE) in fiscal year 1957, and after extensive materials testing, the fiscal year 1958 effort on gas-cooled reactor systems will be devoted largely to fabrication of the experiment core and moderator, and the conduct of a critical experiment. A substantial in-pile gas loop program, consisting of operating loops at Oak Ridge, Battelle Memorial Institute, Hanford, and the engineering test reactor, will be in progress by the latter part of fiscal year 1958 for testing core materials under recirculating gas coolant conditions. Materials testing on advanced systems will continue.

The major elements comprising the cost estimate are as follows:

	Fiscal year 1957	Fiscal year 1958
Research and development	$776,000	$1,860,000
Fuel fabrication	0	440,000
Test operations	0	400,000
Reactor experiment fabrication	535,000	1,000,000
Total	1,311,000	3,700,000

(*d*) Food irradiation reactor:

Fiscal year 1957	$115,000
Fiscal year 1958	100,000

During fiscal year 1958, research and development work will continue on materials and related problems in connection with construction of a food irradiation reactor.

(*e*) Advanced reactor studies:

Fiscal year 1957	$241,000
Fiscal year 1958	500,000

Continuous evaluation of advanced reactor concepts to determine adaptability of results to package reactor systems for foreseeable long-range requirements represents an important phase of this program. Because of expressed Department of Defense interest in even smaller, more compact power reactors than are presently possible through use of pressurized-water, gas-cooled, and boiling reactor systems, there will be research and development effort on fast or intermediate reactor concepts. Potential application will include land vehicle propulson, portable (intact) power sources, and unattended stations. Additional possible efforts planned for fiscal year 1958 include slurry fuel reactors, military plants for production of heat only, and small plants capable of air drop.

3. Naval propulsion reactors, $84 million

The objective of this program is the design and development of a group of naval nuclear-propulsion plants in a wide range of power ratings for use in surface vessels and submarines.

The program contains development of specific reactors for naval propulsion plants; research effort to evaluate new concepts that may produce higher performance and special-purpose powerplants for naval vessels; operation of a testing facility which will contribute to the technology of all water-cooled reactor plants; and operation of an expended-core facility to receive, store, and examine spent cores of the pressurized-water type. The specific reactor projects constitute a program by the Atomic Energy Commission and the Department of the Navy.

The increased fund requirements in fiscal year 1958 result from expansion of development work on specific nuclear-propulsion plants for both submarines and surface vessels and the operation of an expended-core facility.

Additional information of a classified nature is presented on classified pages 100 through 110.

4. Aircraft propulsion reactors, $91 million

The aircraft propulsion reactor program is directed toward the fabrication and testing of nuclear reactors suitable for use in an aircraft propulsion system. Research and development on other components of the propulsion system is covered by Air Force contracts. The application of nuclear power to the propulsion of missiles is also being studied.

The fiscal year 1958 estimate provides for continuation of the research and development program, the fabrication and operation of experiments, and operation of the ground test facilities at the national reactor testing station.

Additional information of a classified nature is presented on classified pages 111 through 116.

5. Merchant ship reactors, $3,300,000

The propulsion plant for the first nuclear-powered merchant ship will utilize an advanced reactor of the pressurized water type. The propulsion plant will become operable in the ship 39 months after start of work. Funds are required in fiscal year 1958 to supplement the basic fabrication effort and to provide testing asistance in lieu of a prototype. Funds are also required in fiscal year 1958 for development of a replacement core. In addition, there will be a materials and design development program building on the experience of the first ship reactor so as to achieve the most economic utilization of this concept in world trade competition.

To insure safe operation and domestic and foreign acceptance of nuclear-powered merchant ships, programs are being initiated in fiscal year 1957 and will continue through fiscal year 1958 in shipboard reactor safety, waste disposal, and crew and passenger safety.

The merchant ship program was established not only to demonstrate the general practicality of nuclear-powered mechant ships, but also to develop nuclear

propulsion systems which could compete economically in world trade. To this end, design and feasibility studies are being undertaken in fiscal year 1957 and will continue into fiscal year 1958. A complementary program of materials and components development will continue in both years. Early in fiscal year 1958 it is expected that these phases of the development program will yield data upon which a decision as to the most promising nuclear propulsion system can be made. In fiscal year 1958 it is expected that this decision will be implemented by effort on in-pile loops, criticality experiments, materials, and core and components development.

The major elements comprising the cost estimates are as follows:

	Fiscal year 1957	Fiscal year 1958
Merchant ship pressurized water reactor:		
Research and development	0	$1,050,000
Fuel fabrication	0	600,000
Subtotal	0	1,650,000
Advanced studies	$664,000	1,650,000
Total	664,000	3,300,000

6. Controlled thermonuclear project (project Sherwood), $21,700,000

Justification for this project is contained on classified pages 116 through 119.

7. Advanced engineering and development, $6,000,000

The objectives of this category are to develop reactor engineering concepts and evaluate engineering data in support of all reactor projects. Although the studies underway are specific, the results obtained therefrom are applicable to many reactor types. The broad reactor engineering techniques developed permit either a direct solution to a specific problem or an indirect solution by means of interpretation or extrapolation of the data. Approximately half of this work is done in national laboratories and half in universities, engineering institutions, other Government agencies and industry.

Specific reactor projects are an outgrowth of such general development work. The major features of each current reactor project are a direct result of prior work in this field. A healthy long-range reactor development program demands that new ideas, materials, components, and processes be continually investigated, that advanced reactor designs be conceived and evaluated, and that associated facilities are feasible from the engineering standpoint.

The work in this category covers the entire field of science and engineering as implied by the foregoing needs. In addition, the economics of the reactor programs require that continued effort be expended to reduce the costs of materials and fabricated components. The work is primarily applied engineering rather than basic engineering and the program attempts to strike a proper balance between immediate problems and the long-range problems associated with advanced concepts.

Major emphasis in fiscal year 1958 will be directed toward the study of materials, moderation, reflection and control, and the development of fuel elements for higher temperature application. The need for the development is pointed up by the increased interest in reactors operating at high temperatures where more efficient operation is being sought for both power and propulsion reactors.

Low-temperature reactor applications require additional general development work in fuel element development and the development of materials and components. Work will be continued in these areas as well as in reactor physics, heat transfer, and specific areas of interest for the military and civilian power-reactors programs.

8. Reactor safety, $11,300,000

Transient tests of thermal heterogeneous reactors of low and high pressure will be continued at the SPERT facility. Transient tests parallel to SPERT, but on homogeneous reactors will be continued in the kinetic experiment on water boiler (KEWB) facility. Mechanisms of disruptive-type reactor explosions will be studied with the aim of minimizing the probability of such occurrences. Development studies of reactor fuses for commercial-power reactors and research reactors will be continued. Investigations will proceed on the resistance of reactor pressure vessels to pressure surges and the building containment problem will be studied both analytically and experimentally in simulated structures.

The mechanisms of possible chemical reactions resulting from a nuclear excursion will continue to be investigated for a number of metals and alloys commonly used in reactor construction. Theoretical and experimental studies will be conducted on the mechanics of ignition of reactor materials to suggest safer handling procedures, and on other specific problems which enable engineers to design inherently safe reactors.

The fast reactor safety program underway in fiscal year 1957 will continue through fiscal year 1958. The EBR–I will be operated in fiscal year 1958 to firmly establish the causes of certain instabilities noted in its earlier operation. In addition, theoretical studies underway in fiscal year 1957 to evaluate the probability of nuclear incidences and means for their control will lead to confirming experimental work in fiscal year 1958.

9. Separations systems development, $10,000,000

Separations systems development programs are directed toward obtaining design criteria or chemical systems for the reprocessing of irradiated reactor fuels and the disposal of highly radioactive reprocessing wastes. In addition, waste disposal studies are conducted which include site selection of reactors and their associated facilities and disposal of wastes generated at existing or proposed atomic energy facilities. The waste disposal activities require extensive coordination with State and local agencies and considerable attention is devoted toward development of engineering technology and methodology for "ultimate disposal" of the large quantities of exceedingly hazardous materials associated with the long-term expansion of the atomic energy program.

Waste treatment studies and waste disposal methods will proceed with major emphasis directed toward pilot plant operations for solidifying wastes and permanently "fixing" hazardous fission products to prevent their release to the environment. Alternate disposal methods are also under investigation.

At present, no proven technologies exist which are applicable to the majority of reactor fuels for whose processing the Commission is already committed. During fiscal year 1958 3 promising approaches will be pursued: (1) extension of the "headend" processing concept to permit the adaptation of existing aqueous processing plants for use with the newer fuel types, (2) reprocessing of fuels by "volatility" based on promising development work already completed, and (3) pilot plant proof of "pyrometallurgical" processing which is required for certain types of reactors.

10. Operational services, $7,100,000

This category includes the operation of facilities such as reactors, processing plants, and test stations.

(a) Operation of test reactors:

Fiscal year 1957	$4,169,000
Fiscal year 1958	5,200,000

The materials testing reactor and the engineering test reactor operate to provide high flux for research purposes for various AEC contractors, AEC-sponsored and public groups in the study of radiation damage; to assist with fundamental research of transuranic and other elements; to aid in the development of fuel elements for various types of reactors; to produce isotopes; and to provide a source of neutrons for cross section measurement work. The increase in fiscal year 1958 is due to a full year's operation of the engineering test reactor which will be completed during the early part of fiscal year 1958.

The major elements comprising the cost estimate are:

	Fiscal year 1957	Fiscal year 1958
Materials testing reactor:		
Gross cost of operation	$4,200,000	$3,900,000
Less irradiation services for other programs	1,000,000	1,100,000
Net cost	3,200,000	2,800,000
Engineering test reactor:		
Gross cost of operation	969,000	2,800,000
Less irradiation services for other programs	0	400,000
Net cost	969,000	2,400,000

(b) Operation of the chemical processing plant:

Fiscal year 1957	$1,214,000
Fiscal year 1958	1,000,000

This is a continuing activity and provides for the routine operation of the chemical processing plant at the national reactor testing station in Idaho to recover enriched uranium from irradiated fuel elements. In fiscal year 1957 and fiscal year 1958, the fuel processing for reactor development will be reduced and the fuels processed will be primarily for special nuclear materials program. The increase in gross cost of operation is due primarily to changes in the amount of chemicals required to process the scheduled quantities of materials. Only the costs to the reactor development program are budgeted here.

Details of the cost estimate are:

	Fiscal year 1957	Fiscal year 1958
Gross cost of operation	$3,414,000	$3,883,000
Less revenues	130,000	130,000
Less costs distributed to special nuclear materials program	2,070,000	2,753,000
Net costs	1,214,000	1,000,000

(c) Operation of the National Reactor Testing Station:

Fiscal year 1957	$200,000
Fiscal year 1958	700,000

This activity is for operating and maintaining the National Reactor Testing Station. The costs are distributed to the programs using the services of the station. The gross cost of operation will increase in fiscal year 1958 due to the increase in usage by programs recently completed or expanded at the station. The costs remaining are for overall site planning and development, and a nonrecurring cost for additional communication cables in fiscal year 1958.

Details of the cost estimate are:

	Fiscal year 1957	Fiscal year 1958
Gross cost of operation	$3,764,000	$4,705,000
Less:		
Revenues	780,000	961,000
Costs distributed to special nuclear materials program	134,000	371,000
Costs distributed to weapons program	15,000	11,000
Costs distributed to reactor development program	2,626,000	2,662,000
Net costs	200,000	700,000

(d) Transportation and security shipments:

Fiscal year 1957	$189,000
Fiscal year 1958	200,000

This estimate is for coordinating, escorting, and providing armed protection for shipments of highly classified materials and documents, as well as materials that cannot be transported by common carrier because of health and safety hazards.

11. Equipment not included in construction projects, $17,500,000

Equipment requirements for the reactor development program are estimated at $17,500,000 for fiscal year 1958. This requirement is to support the continued growth in the program for development of civilian and military reactors. Approximately two-thirds of the amount requested is required to support the aircraft propulsion reactors program and the naval propulsion reactors program. The other major requirement is for the civilian power reactor program which is increasing in fiscal year 1958.

There follows a breakdown of the total equipment costs indicating amounts estimated for each major installation in relationship to its other operating costs under this program.

[In thousands]

Installation	Other operating costs	Equipment costs
Lockland, Ohio, plant, General Electric Co	$41,500	$4,350
Hartford, Conn., plant, Pratt & Whitney	15,700	1,000
Bettis plant, Pittsburgh, Pa	65,500	3,500
Knolls Atomic Power Laboratory	27,345	1,000
Windsor, Conn., plant, Combustion Engineering Co	9,500	510
Argonne National Laboratory	21,852	1,000
Oak Ridge National Laboratory	34,455	1,532
National Reactor Testing Station, Idaho	13,675	1,010
Los Alamos Scientific Laboratory	17,480	1,000
Princeton University	8,200	580
All other	81,568	2,018
Total costs	336,775	17,500

Additional information of a classified nature is presented on classified pages 100 through 119.

Mr. BOLAND. We previously passed over the reactor development program because there were some items which were in conflict with the authorization bill.

In fiscal 1958 you asked for $354,275,000 as compared with $264,713,000 in fiscal 1957, a total increase of $89.562,000. Will you give the committee a brief outline of the reasons for the increase.

Mr. FIELDS. Yes, sir. This is a reflection of the increases in the various parts of the reactor development program. If you would turn to page 57 you will see we have that categorized by major programs.

CIVILIAN POWER REACTORS

The first category is the civilian power reactor program where in 1957 we estimate $53,775,000. For fiscal 1958 there is an increase of approximately $43 million for the step-up of the development programs for civilian power reactors. There is an increase particularly in the level of effort in the different major concepts that are being worked out in the direct Government program. The direct Government program increases from $51,781,000 to $82,849,000. That is for research and development done at Commission installations, such as the Argonne Laboratory or the Oak Ridge National Laboratory or under direct contracts for specific development work done for the Commission.

The second item, (b), is the cooperative arrangements program in which the estimate increases to $13,926,000, and that is the item in which we are participating with industry in development of reactors. This is a program which is carried in the authorization bill that the House recently passed but which has not as yet been passed by the Senate.

For the Army power reactors, item 2, there is an increase to $5,600,000. This calls for the operation of the Army package power plant at Fort Belvoir which went into operation this year, and development work on two other concepts. I believe these are covered in the text later on.

MILITARY REACTORS

There are three military programs, Army power reactors, naval propulsion reactors, and aircraft propulsion reactors. These latter two programs are for the development work up through the prototype

stage where there is a military need for propulsion reactors. The Army program happens to be for a package unit to produce electric power.

The naval reactor program is covered at some detail in the classified sheets. It points toward the development of reactors for submarines, aircraft carriers, and for cruisers.

The aircraft propulsion program is for the development of nuclear propulsion plants for aircraft on which we are working with the Air Force. It involves engine development as well as nuclear reactor development.

Am I covering this in the manner that you wish, Mr. Chairman?

Mr. BOLAND. Yes.

MERCHANT SHIP REACTOR

Mr. FIELDS. In the merchant ship reactor program, as you know, we and the Maritime Administration in accordance with Public Law 848, 84th Congress, are engaged in the construction of a nuclear propelled merchant ship. Money was previously appropriated to get this project underway. This program also looks toward the development of improved reactors such as a gas-cooled version of a propulsion unit for merchant ships. We are working with the Maritime Administration under a coordinated program looking toward the eventual use of propulsion units in merchant ships.

CONTROLLED THERMONUCLEAR PROJECT (PROJECT SHERWOOD)

The next item is the controlled thermonuclear project which is a study of the use of the thermonuclear process for the development of electric power in the hope that we can tap that great source of energy. This program will increase from a level in 1957 of $11 million to $21,700,000 in fiscal 1958. We have a number of our major laboratories engaged in extensive research and development in that program which is really a program of great interest to all of us, and to this country.

ADVANCED ENGINEERING AND DEVELOPMENT

Advanced engineering and development is an item that decreases to $6 million. This, as is indicated, is for support, at various of our laboratories, of engineering development work related to reactor projects of all types.

REACTOR SAFETY

The eighth item, reactor safety, points toward a marked increase in our efforts for studying the behavior of reactors and their performance and toward the establishment of criteria on which to judge their safety. We are looking at the major fundamentals that we need to know in order to judge the safety reactors. We have a number of specific reactor experiments that will contribute to this through the operation of such things as the SPERT reactors. There will be several of these at Arco, and there are other types of reactors which will provide us with fundamental data to assist in this very important area.

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SEPARATIONS SYSTEMS DEVELOPMENT

Separations systems development is associated with all reactors and is a very critical item in the comparison of economic performance. It deals with the cost of the separation of fuel after you have burned it to the extent that you can.

There will also be quite a large residue in some cases of valuable fissionable materials. This particular item, separations systems development, looks toward the development of means of reprocessing the fuel to recover the valuable fissionable material and toward reducing the cost of that reprocessing which is such a key part in the whole cycle of nuclear power.

OPERATIONAL SERVICES

Operational services are just what the name indicates. It includes the services that are performed at the Arco National Reactor Test site, in the operation of the materials-testing reactor and the engineering-test reactor as well as for the other aspects of the operation of the National Reactor Test Station.

EQUIPMENT NOT INCLUDED IN CONSTRUCTION

The last item is for equipment which is not included in construction projects. The amount remains about the same as it was last year for the provision of equipment for the support of the reactor program. That very briefly sketches the major categories that are included in the operating appropriation request for the reactor program.

Mr. BOLAND. How much was actually spent last year in this work?

FISCAL YEAR 1957 COSTS FOR REACTOR DEVELOPMENT PROGRAM

Mr. MCCARTHY. The actual costs in this program were $266,682,000. You will note that is $2 million above the estimate we have here. We revised the estimate in June, taking the May actual and projecting June, and arrived at the $264 million estimate.

Mr. BOLAND. Your original estimate last year was $285 million.

Mr. FIELDS. Yes. That was the amount requested from Congress.

Mr. BOLAND. Is there any cushion in the 1958 figure?

Mr. MCCARTHY. No, sir. There were two changes in the fiscal 1957 program. There was a small change in the naval propulsion category resulting primarily from delays in using zirconium, and other materials. Actually we were producing the zirconium. It was not fabricated into shapes as fast and it fell into our inventory program. There was also some underrun in the aircraft nuclear program, again part of it from materials and part of it from reduction in one of the missile projects from a two-laboratory effort to one. Generally the fiscal 1958 amount seems to be a reasonable estimate at this time.

GAS-COOLED REACTORS

Mr. BOLAND. I notice on the Government program on page 58, there is not any program that embraces the gas-cooled reactors. Are you going out of that field?

Mr. FIELDS. Mr. Chairman, the gas-cooled work we are doing is in the Army program at the moment and in the merchant ship program. I believe there may be some covered in power reactor advance design. I would like to ask Mr. Davis, Director of the Reactor Development Division, to speak to that point.

Dr. DAVIS. As General Fields said, there is a program which is one of the Army reactor programs which is directed toward a very small high temperature gas-cooled reactor. We are just getting started on development of a gas-cooled reactor for the maritime propulsion field, having had a number of studies made during the past year or so. There are some funds in the power reactor advance design funds, as well as in the advanced engineering development funds—I don't recall the exact split.

Mr. BOLAND. There is not much in that fund.

Dr. DAVIS. As between the power reactor advance design funds and the engineering development funds which are on page 57 as item 7, I cannot give you the exact breakdown offhand for such studies as Ford Instrument has carried out a study of a gas-cooled reactor for us. Other studies are being conducted by North American Aviation, Atomics International Division, by American Radiator and Standard, and by Hanford of gas-cooled reactors and their evaluations.

AIRCRAFT PROPULSION REACTOR

Mr. BOLAND. In the aircraft propulsion reactor, how is that advancing and how close are you to a prototype?

(Discussion off the record.)

Mr. BOLAND. Does the AEC work with the National Advisory Committee for Aeronautics?

Dr. DAVIS. Yes. They are doing quite a bit of work primarily with the Air Force on system studies, configurations for supersonic bombers, and things of this sort.

Mr. BOLAND. Those are all the questions I have. Are there any questions that you wish to propound, Mr. Jensen?

RELATION OF BUDGET ESTIMATES TO AUTHORIZATION BILL

Mr. JENSEN. I have just a few. Will the changes in the authorization bill which Congress finally passes necessitate a change in your budget request as you see it at this time?

Mr. FIELDS. I can only answer it with respect to the bill as passed by the House. I don't know what the bill will contain when it becomes law.

Mr. JENSEN. I understand.

Mr. FIELDS. With respect to that bill, we do have in our plant program—the capital budget which we have not reviewed with you as yet—an item of $9 million for the construction of a power reactor in Puerto Rico which was not in the authorization bill and which therefore would not be authorized for appropriations.

The remaining part of our estimate for our plant program is in accordance with the bill as passed by the House with the exception of one item. This is the $3 million project for the conduct of development and study work leading toward the plans for the construction of a reactor for production of plutonium or a possible dual purpose

reactor which was added to our proposal for authorization legislation by the Joint Committee on Atomic Energy. We have not as yet determined what we should do with respect to a request for funds for that project. We are waiting until we see what action the Senate will take. Otherwise, the request before you is in line with what the House passed.

Mr. JENSEN. That is what I wanted to establish. So the facts are that the action taken by the House on the authorization bill was almost completely in line with what the Atomic Energy Commission had originally requested in the budget, is that correct?

Mr. STRAUSS. Barring the elimination of the Puerto Rican reactor.

CONSTRUCTION OF SODIUM GRAPHITE REACTOR IN NEBRASKA

Mr. JENSEN. What is the type reactor being constructed in Nebraska?

Mr. FIELDS. This will be the sodium graphite type of reactor.

Mr. JENSEN. Is that the only plant you have in which you are experimenting with that type of reactor?

Mr. FIELDS. We have an experimental reactor, the Sodium Reactor Experiment, which is a much smaller size experimental type reactor now in operation at Santa Susana, Calif. This experiment is to prove the technology of this kind of system. The sodium graphite reactor in Nebraska would be the only full scale powerplant employing that type of concept.

Mr. JENSEN. What is the kilowatt capacity of the Nebraska reactor?

Mr. FIELDS. It is planned at 75,000 kilowatts.

Mr. JENSEN. That is quite a large capacity.

Mr. FIELDS. That is a very large capacity plant.

Mr. JENSEN. What is the largest capacity that you are now building?

Mr. FIELDS. Mr. Davis, could you answer that? I recall the Yankee is estimated around 100,000, and will go to around 134,000.

Dr. DAVIS. The Commonwealth Edison boiling water plant is rated at 180,000 kilowatts. The Consolidated Edison plant is rated at 275,000 kilowatts, with perhaps 40 percent coming from an oil-fired superheater.

Mr. STRAUSS. So there is no mistake in the record, Mr. Jensen's question, as I heard him, concerned reactors which we are now building.

Mr. JENSEN. That is right.

Mr. STRAUSS. We are not building those last two. They are being built by American industry.

Mr. JENSEN. I know that. How about Shippingport?

Dr. DAVIS. The size of Shippingport has been generally given as 60,000 net electrical kilowatts. Actually the Duquesne Light Co. has installed a 100,000-kilowatt turbogenerator which would give about 90,000 net electrical kilowatts if there is enough steam to operate it.

Mr. JENSEN. Does the plant in Nebraska have the greatest kilowatt output of any plant that the Atomic Energy Commission is constructing?

Mr. STRAUSS. No, there are 75,000 kilowatts for Nebraska and a possible 90,000 for Shippingport.

Mr. JENSEN. Under what kind of agreement are you building that plant in Nebraska?

Dr. DAVIS. We do not have a contract as yet. The plan we have been following would be that the Commission would contract with North American for the research and development, component testing and the engineering design of the nuclear portion of the plant, that we would contract with someone as yet unselected for the engineering design of the plant as a whole and for the construction, and with Consumers Public Power District to provide the plant and to make some arrangements with them about the cost of the fuel elements which would go into the plant.

Mr. JENSEN. You have a contract, do you not, with the Consumers Public Power District?

Dr. DAVIS. We do not have a contract with them as yet.

Mr. JENSEN. Are you negotiating a contract?

Dr. DAVIS. We have been negotiating one for some time; yes, sir.

Mr. JENSEN. If you are not successful in negotiating that contract, then how do you propose to dispose of your power?

Dr. DAVIS. We would not build it there if we were not successful in negotiating a contract.

Mr. JENSEN. Have you not started to build a reactor?

Dr. DAVIS. No, sir.

Mr. STRAUSS. The experimental reactor, graphite moderated and liquid sodium cooled, which is the prototype, has been built. That is the one at Santa Susana, Calif., to which the General Manager just referred, and which is today running.

(Discussion off the record.)

ADVANCED ENGINEERING AND DEVELOPMENT

Mr. JENSEN. I think that is good enough. To what extent are these unsolved metallurgical and chemical problems that must be overcome before large scale reactors can be constructed in the process of being solved?

Dr. DAVIS. This is one of the major activities of the engineering development program, the solution of many of the chemical or metallurgical problems, to the extent that they are not covered by these particular projects which also do a great deal of metallurgical work. I think in general in almost all of the reactors we are working on, except possibly some of the military reactors, we do know of materials which look as though they will work all right. But when we come to the civilian power reactors, our real problem is not only to find materials which will work but which will be sufficiently cheap. In this area we have a very serious problem not only in finding materials and investigating the properties under the actual conditions, but also finding out how we can do this sufficiently cheaply. It turns out that is a very serious problem itself. For example, in the case of the pressurized water reactors, we do know you can build successful ones using zirconium as the material for either alloying the uranium or for cladding, but the cost of zirconium and the cost of working with zirconium is so high that it is very difficult to see how you can build a reactor for making central station power that is sufficiently cheap. This is getting better as time goes on and we learn more about it.

The Yankee Co. is trying a reactor which will utilize stainless steel. Stainless steel is not as good as a nuclear material but it is a lot cheaper. We have work going on at Argonne on some aluminum alloys which if they work out will be utilized in pressurized water reactors and may be a great deal cheaper than stainless steel. It is not clear whether these materials will stand up. This is the direction in which it is going and quite encouragingly, although perhaps slower than some people would like.

ARMY POWER REACTOR AT FORT BELVOIR

Mr. JENSEN. In your plant at Fort Belvior, that is a presurized-water reactor?

Dr. DAVIS. Yes.

Mr. JENSEN. Is it completed?

Dr. DAVIS. Yes; it is in operation.

Mr. JENSEN. You are furnishing power now?

Dr. DAVIS. It is furnishing power to the fort; yes.

Mr. JENSEN. How long has it furnished power to the fort?

Dr. DAVIS. It went into operation in April and has been in operation fairly steady since. It has completed a 700-hour performance test that was a part of our contract with the Alcoa Products Incorporated which is, I suspect, the severest performance test that any reactor has had.

Mr. JENSEN. What is the capacity of that plant?

Mr. DAVIS. About 2,000 kilowatts.

Mr. JENSEN. A number of the members of the committee visited the plant last year and when they got through we were nuclear scientists, all of us, I am sure. But I will say it was very interesting and we did understand the matter a little better when we got through. Quite a little better, I would say, because you have to see it in order to get your teeth into the subject. Isn't it a fact that you have problems that you have not overcome which you will have to overcome in building a larger plant of that nature? There are some concepts you must still work out?

Dr. DAVIS. That is the pressurized-water reactor and therefore is not greatly different from the concept of the PWR. We had two difficulties with the Army package power reactor plant at Fort Belvoir, the first of which was that there was a defective winding in the generator which had nothing at all to do with the nuclear portion of the plant. The second difficulty that held up the 700-hour performance test was that the steam separator did not have quite the proper characteristics which again had nothing whatever to do with the nuclear portion of the plant.

I might add this was one of the troubles we had with the *Nautilus*.

Mr. JENSEN. You learn some very important things when you build a pilot plant, so to speak, such as the one you built at Fort Belvoir. You learn some things about the mechanical end which will stand us well in building a larger plant.

That is all, Mr. Chairman.

PLANT ACQUISITION AND CONSTRUCTION

Mr. BOLAND. We will turn to book 2 on capital budget plant acquisition.

Mr. Reporter, will you please insert pages 242 to 249 on the summary of requirements for fiscal year 1958.

(The information follows:)

GENERAL STATEMENT

SUMMARY OF REQUIREMENTS FOR FISCAL YEAR 1958

The budget estimates for the appropriation plant acquisition and construction for the fiscal year 1958 provide for total obligations of $420,273,000, of which funds in the amount of $296,648,000 are presently available from prior year appropriations, requiring a new appropriation of $123,625,000.

Of the total amount of funds presently available, namely $296,648,000, $193,441,000 is required for prior year projects which were not fully contracted for in fiscal year 1957. The remainder of the funds presently available, $103,207,000, consists of (*a*) $38,296,000 previously appropriated for power reactor development acceleration, which amount was reauthorized in the fiscal year 1958 authorization act for cooperative arrangements, and (*b*) $64,911,000 which is a net free unobligated balance resulting from the elimination or deferment beyond fiscal year 1958 of projects previously appropriated for or changes in the total estimated cost of projects previously appropriated for.

The prior year projects which have not been fully contracted and for which $193,441,000 of funds presently available are carried forward for obligation in fiscal year 1958 are identified in section B under each program throughout this document. The newly authorized projects requiring obligation of $226,832,000 in fiscal year 1958, which are to be funded by the new appropriation of $123,625,000 and the remainder of funds presently available, $103,207,000, are identified in section A under each program throughout this document.

A summarization of the fiscal year 1958 obligations by program, showing the application of funds presently available and the derivation of the new appropriation requirement is shown on the following page.

Summary of obligations for fiscal year 1958 by program

Program	Fiscal year 1958 obligations		
	Section A (new)	Section B (carryover)	Total
Raw materials	$450,000	$1,500,000	$1,950,000
Special nuclear materials	41,450,000	94,350,000	135,800,000
Weapons	43,531,000	27,553,000	71,084,000
Reactor development	126,246,000	52,951,000	179,197,000
Physical research	7,605,000	9,961,000	17,566,000
Biology and medicine	1,441,000	381,000	1,822,000
Training, education, and information	2,500,000	0	2,500,000
Community	3,159,000	3,572,000	6,731,000
Administrative	450,000	3,173,000	3,623,000
Total obligations	226,832,000	193,441,000	420,273,000
Unobligated balances brought forward	−[1]103,207,000	−193,441,000	−296,648,000
Appropriation	123,625,000	0	123,625,000

[1] Of this amount $38,296,000 was previously appropriated for power reactor development projects and reauthorized for cooperative power arrangements in the fiscal year 1958 authorization act.

THREE YEAR SUMMARY OF OBLIGATIONS AND FINANCING OF OBLIGATIONS

The following tables summarize the total obligations incurred for each of the AEC's major construction programs for fiscal year 1956, fiscal year 1957, and fiscal year 1958, and the sources of funding these obligations:

Summary of obligations by program

Program	Actual, fiscal year 1956	Estimate, fiscal year 1957	Estimate, fiscal year 1958
Raw materials	$3,286,668	$5,125,000	$1,950,000
Special nuclear materials	43,004,105	46,740,000	135,800,000
Weapons	42,863,306	66,281,000	71,084,000
Reactor development	60,005,850	105,214,475	179,197,000
Physical research	5,997,214	23,048,000	17,566,000
Biology and medicine	6,205,062	1,405,000	1,822,000
Training, education, and information	0	0	2,500,000
Community	3,551,625	5,159,000	6,731,000
Administrative	9,461,455	1,888,000	3,623,000
Total	174,375,285	254,860,475	420,273,000

Summary of financing

	Fiscal year 1956	Fiscal year 1957	Fiscal year 1958
Funds available:			
Unobligated balance at beginning of year	$755,331,370	$375,810,475	$296,648,000
Recovery of prior year obligations	154,449,000	28,898,000	0
Appropriations	259,227,000	158,300,000	123,625,000
Total amount available for obligations	1,169,007,370	563,008,475	420,273,000
Less:			
Transfer to operating expenses	−571,400,000	−11,500,000	0
Comparative transfer to operating expenses	−47,421,610	0	0
Unobligated balance at end of year	−375,810,475	−296,648,000	0
Obligations	174,375,285	254,860,475	420,273,000

EXPENDITURES FOR PLANT ACQUISITION AND CONSTRUCTION

Expenditures for plant acquisition and construction for fiscal year 1958 are estimated to be $240 million, a decrease of $20 million under the estimate of $260 million in fiscal year 1957. Actual expenditures in fiscal year 1956 totaled $287,377,854. Unexpected balances are expected to decrease from $1,328,297,063, at the beginning of fiscal year 1956 to an estimated $471,982,210 at the end of fiscal year 1958 as shown in the following table which depicts the amounts available for expenditure and the expenditures for each year, and the unexpended balances at the end of each year:

	Actual fiscal year 1956	Estimate fiscal year 1957	Estimate fiscal year 1958
Unexpended balance beginning of year	$1,328,297,063	$728,746,209	$588,357,210
Appropriation	259,227,000	158,300,000	123,625,000
Transfer to "Operating expenses" (deduct)	−571,400,000	[1] −38,688,999	0
Total funds available	1,016,124,063	848,357,210	711,982,210
Expenditures (deduct)	287,377,854	260,000,000	240,000,000
Unexpended balance, end of year	728,746,209	588,357,210	471,982,210

[1] Includes $27,188,999 unpaid obligations transferred to "Operating expenses" at the time funding for equipment not included in construction projects was transferred to that appropriation.

HIGHLIGHTS OF CONSTRUCTION PROGRAMS

As shown in the table on page 242 estimates are presented for construction requirements for each of the AEC's functional programs. The highlights of the estimates for new projects and projects for which appropriation requests have been deferred until fiscal year 1958 are as follows (excludes reference to projects for which funds have been previously appropriated and are carried over into fiscal year 1958 by reason of not having been fully contracted in fiscal year 1957):

1. *Raw materials.*—Obligations for raw materials facilities in fiscal year 1958 are estimated at $0.5 million to provide for minor modifications and improvements to existing plants or installations at Grand Junction, Colo.; Moab, Utah; and Monticello, Utah.

2. *Special nuclear materials.*—Obligations for special nuclear materials facilities in fiscal year 1958 are estimated at $41.5 million to provide $10.0 million for improvements to production and supporting installations at Hanford and Savannah River; $5.0 million for construction of a manufacturing plant for the fabrication of fuel elements; $1.5 million for a mechanical production line at Hanford; $0.9 million for a metal treatment plant at Fernald, Ohio; $8.1 million for additions to gaseous diffusion and scrap plants; $6.0 million for necessary modifications to gaseous diffussion plants to reduce fire hazards; and $10.0 million for improvements, modifications, and additions to existing plants to increase production, eliminate health and safety hazards; and reduce operating and maintenance costs.

3. *Weapons.*—Obligations for weapons facilities in fiscal year 1958 are estimated at $43.5 million to provide $26.2 million for additional production capacity and research and development facilities, $2.0 million for storage site modifications; $8.3 million for modifications and additions at weapons proving grounds; and $7.0 million for general plant projects related to the weapons program.

4. *Reactor development.*—Obligations for reactor development facilities in fiscal year 1958 are estimated at $126.2 million to provide $22.5 million for construction of AEC research and development installations, housing for experimental reactors, and AEC experimental reactors; $38.3 million for cooperative arrangements; $10.0 million for a fuel technology center; $9.0 million for a demonstration nuclear powerplant in Puerto Rico; $22.2 million for construction related to military reactor projects; $5.0 million for construction related to control of thermonuclear energy for civilian power purposes; $9.7 million for projects related to fuel separation systems; and $9.5 million for general plant projects and supporting projects.

5. *Physical research.*—Obligations for physical research facilities in fiscal year 1958 are estimated at $7.6 million to provide $1.5 million to initiate a project for the construction of a high energy accelerator; $4.8 million for improvements to existing accelerators, research reactors and the cosmotron; and $1.3 million for general plant projects.

6. *Biology and medicine.*—Obligations for biology and medicine facilities in fiscal year 1958 are estimated at $1.4 million to provide $0.5 million for the construction of an additional biological area for maintaining experimental animals to obtain data on their reactors and behavior to radiation injury and recovery, and $0.9 million for general plant projects.

7. *Training, education, and information.*—Obligations for training, education, and information facilities in fiscal year 1958 are estimated at $2.5 million million to provide a regional nuclear training center in Puerto Rico.

8. *Community.*—Obligations for community facilities in fiscal year 1958 are estimated at $3.2 million to provide $1.0 million for housing modifications at Los Alamos; $1.0 million for school facilities at Los Alamos, $0.4 million for lot development at Los Alamos, and $0.8 million for general plant projects at Oak Ridge, Hanford, Los Alamos, Sandia, and Grand Junction.

9. *Administrative.*—Obligations for administrative facilities in fiscal year 1958 are estimated at $0.4 million for general plant projects.

PROPOSED LANGUAUE FOR THE PLANT ACQUISITION AND CONSTRUCTION APPROPRIATION FISCAL YEAR 1958

"Plant acquisition and construction: For expenses of the Commission in connection with the purchase and construction of plant and other expenses incidental thereto necessary in carrying out the purposes of the Atomic Energy Act of

1954, *as amended*, including the acquisition or condemnation of any real property or any facility or for plant or facility acquisition, construction, or expansion; and hire of passenger motor vehicles; [$158,300,000] *$123,625,000* to remain available until expended [: *Provided*, That the obligated balance as of June 30, 1956, of amounts included in appropriations to the Atomic Energy Commission for 'Plant and Equipment,' for the activity 'Equipment not included in construction projects,' shall be transferred to and merged with the appropriation for 'Operating expenses,' and the remaining balance of such appropriations shall be merged with this appropriation: *Provided further*, That, in the event additional feed materials capacity is constructed by private industry with its own funds, the amounts included in this appropriation for such construction may be transferred to the appropriation for 'Operating expenses']."

EXPLANATION OF PROPOSED LANGUAGE CHANGES—PLANT ACQUISITION AND CONSTRUCTION

Proposed changes in language are indicated as follows: language enclosed in brackets [ ] indicates proposed deletions, and italic indicates proposed insertion of new language.

1. Atomic Energy Act of 1954, *as amended*

The insertion of the words "as amended" updates the citation of the basic act to include reference to the subsequent amendments.

2. [$158,300,000] *$123,625,000*

The amount appropriated in fiscal year 1957 is deleted and the amount of the fiscal year 1958 appropriation request is inserted.

3. [Provided, that the obligated balance as of June 30, 1956, of amounts included in appropriations to the Atomic Energy Commission for "Plant and Equipment," for the activity "Equipment not included in construction projects," shall be transferred to and merged with the appropriation for "Operating Expenses," and the remaining balance of such appropriations shall be merged with this appropriation:]

This language is deleted since the transfer of obligated balances authorized therein has been accomplished.

4. [Provided further, That, in the event additional feed materials capacity is constructed by private industry with its own funds, the amounts included in this appropriation for such construction may be transferred to the appropriation for "Operating Expenses."]

This language is deleted since the transfer authorized therein has been accomplished in the amount of $11,500,000.

UNOBLIGATED BALANCES

Mr. BOLAND. In this particular section, Mr. Fields, I notice where there is a statement to the effect that you have $64,911,000 in net free unobligated balance. Does that mean we can reduce your request that amount?

Mr. FIELDS. That means it is incorporated in the unobligated balances brought forward into fiscal year 1958 as shown on page 243.

Mr. BOLAND. That reduction is included?

Mr. FIELDS. The reduction is taken against the total new obligations planned for fiscal 1958. The total new obligations on page 243 are estimated, with the two exceptions that I mentioned with respect to the authorization bill before, to be $226,832,000. We are applying against that the unobligated balance of $103 million which includes the $65 million that you referred to and $38 million that was previously appropriated for the power reactor development project.

Mr. BOLAND. There are no other unobligated balances anywhere for plant acquisition and construction. That is the total?

Mr. FIELDS. Yes, sir.

Mr. BOLAND. The unobligated balances are considered in the appropriation request for fiscal 1958?

Mr. FIELDS. Yes, sir.

Mr. BOLAND. The authorization for plant and equipment usually includes an overrun of 25 percent; does it not?

Mr. FIELDS. It depends upon the item, sir. Some items have an overrun allowance of 25 percent, some 10 percent and there are a few in which the overrun allowance is zero.

Mr. BOLAND. I do not care about the details. What is the percent for contingencies? Do you provide a percentage?

Mr. FIELDS. In most of the estimates you will find a contingency allowance. It varies a little bit depending on the complexity of the project. It is of the order of 10 percent for most projects.

Mr. BOLAND. If there are no questions, we shall go to raw materials.

RAW MATERIALS PROGRAM—CONSTRUCTION OBLIGATIONS

Will you insert pages 252 and 253 in the record, Mr. Reporter.

(The information follows:)

RAW MATERIALS PROGRAM—CONSTRUCTION OBLIGATIONS

Program statement

Estimated obligations, fical year 1958	$1,950,000
A—Obligations for new projects	(450,000)
B—Obligations for prior year projects	(1,500,000)
Estimated obligations, fiscal year 1957	5,125,000
Actual obligations, fiscal year 1956	3,286,668

Obligations for the raw-materials program for fiscal year 1958 are estimated at $1,950,000, of which $450,000 is for a new project justified in section A below which was authorized in the fiscal year 1958 Authorization Act. The balance of $1,500,000 is for a project listed under section B below which was authorized prior to fiscal year 1958 and for which funds have previously been appropriated but are now carried over into fiscal year 1958.

SECTION A

The project in section A is:

Project No.	Title	Total estimated cost	Obligations incurred through fiscal year 1957	Estimated obligations, fiscal year 1958	Funding required after fiscal year 1958 to complete project
58-L	General plant projects	$450,000	0	$450,000	0

Explanation of project in section A

1. *Project 58-L General plant projects, $450,000.*—The Commission-owned raw materials facilities have a total capital value of approximately $14 million. The estimated cost of this project represents approximately 3 percent of that amount. The project provides for minor capital improvements, alterations, additions, engineering, retirements, and minor new construction which are required to maintain continuity of operation, improvement in production techniques, elimination of health and safety hazards, and the reduction of operating and maintenance costs in the procurement, processing, and supporting facilities of the Grand Junction Operations Office. Provision is also made for minor capital improvements, alterations, and/or additions at the Raw Materials Development Laboratory at Winchester, Mass. and the pilot plant at Grand Junction, Colo.

SECTION B

The project in section B has been previously authorized and funds have previously been appropriated but are now carried over into fiscal year 1958:

Project No.	Title	Total estimated cost	Obligations incurred through fiscal year 1957	Obligations to be incurred in fiscal year 1958
57-L-1	Offsite access roads	$2,073,000	$573,000	$1,500,000

Mr. FIELDS. Our estimated obligations in fiscal 1958, are in the amount of $1,950,000. You will note there is a (B) section which contains obligations for prior years projects. That is for previously authorized and appropriated projects which are carried over into fiscal 1958 for completion.

GENERAL PLANT PROJECTS

For raw materials the only new item for which we are requesting obligation is general plant projects. This is a project to take care of miscellaneous minor construction. By the language of the authorization act itself, there is a limitation in the amount of $500,000 for technical projects in which a building itself cannot exceed $100,000. In this case, it is for the support, maintenance and miscellaneous construction of facilities that are operated by our Grand Junction Operations Office and for alterations and additions to the laboratory at Winchester, Mass. Or the pilot plant at Grand Junction. It is at the level we have experienced in this program in previous fiscal years.

Mr. BOLAND. Are there any questions on that section, Mr. Jensen?

Mr. JENSEN. No.

SPECIAL NUCLEAR MATERIALS PROGRAM-CONSTRUCTION OBLIGATIONS

Mr. FIELDS. The next program is the special nuclear materals program and here the obligation for new projects is in the amount of $41,450,000, and these are shown on page 254.

58-B-1 FABRICATION PLANT

They entail a fabrication plant which is for the provision of a plant associated with our feed materials plant, for the production of certain types of fuel elements for our production reactors.

58-B-2 MECHANICAL PRODUCTION LINE

The second item is a mechanical production line at Hanford, Wash., of $1,500,000.

58-B-3 METAL TREATMENT PLANT

The next item is a metal treatment plant at Fernald, Ohio, in the amount of $850,000. This again is permitting increased operating efficiency in the production of fuel elements produced in that feed

materials line. It has to do with some pickling facilities for handling more economically the ingots that go through there.

58–B–4 IMPROVEMENTS TO PRODUCTION AND SUPPORTING INSTALLATIONS

The next item in the amount of $10 million is for the improvement to production and supporting installations at Hanford, Washington, and Savannah River, S. C. These plants have large producing reactors in very extensive facilities there. They also have a separations facility associated with them. These are very complex and expensive facilities. The total investment in these facilities is in the neighborhood of $4 billion. This item is for the improvement of these reactors looking toward better production. We have had expenditures of this nature throughout the years and as a result the production that we achieve from these plants has gone up markedly.

58–B–5 ADDITIONS TO SCRAP PLANTS

The next item in the amount of $1.5 million is for additions to scrap plants at various sites. It is to process substantial stockpiles of both high grade and low grade scrap going through the feed materials plant. This will be an economical operation, we believe, and will result in the recovery of virgin materials that have been accumulating in scrap at our feed processing plants.

58–B–6 ADDITIONS TO GASEOUS DIFFUSION PLANTS

The additions to the gaseous diffusion plants in the amount of $6,600,000 are for necessary modifications in the recirculating water system.

58–B–7 REDUCTION OF FIRE HAZARDS, GASEOUS DIFFUSION PLANTS

The next item is for the reduction of fire hazards at our three gaseous plants. The authorization as approved by the House is in the amount of $12 million, however only $6 million is requested for obligation in fiscal 1958. We had a fire at the Paducah plant last year, and we became quite concerned about the roof construction and the potential fire hazard in that type of construction. As a result we believe there should be major modifications to that roof construction, as well as a system for detecting and extinguishing fires that may arise from that cause. It is of great concern to us and we believe it would be money well spent.

GENERAL PLANT PROJECTS

General plant projects have an authorized item of $10 million which would be associated with the miscellaneous construction associated with this industrial complex at Hanford, Oak Ridge, and Savannah River, primarily. Also, at the feed material plants. It is to take care of the minor construction at a maximum amount of individual projects of $500,000, with building construction limited to $100,000. There is always a group of minor construction needed to assure the operability of these large facilities.

58–B–1 FABRICATION PLANT

Mr. BOLAND. On 58 (b) (1), I understand that is an extrusion plant.

Mr. FIELDS. That is true.

(Discussion off the record.)

58–B–4 IMPROVEMENTS TO PRODUCTION AND SUPPORTING INSTALLATIONS

Mr. BOLAND. Item 58 (b) (4), what were our prior appropriations on that in the last 2 years, or what were the levels of expenditure?

Mr. BLOCH. Obligations for these types of items, ran about $7.5 million in fiscal 1955, for fiscal 1956 about $19 million, and for fiscal 1957 about $5,800,000, all at Hanford.

Mr. BOLAND. What did you expend in 1957 as a total?

Mr. BLOCH. For this item?

Mr. BOLAND. Yes, just for this item.

Mr. BLOCH. Our total obligations were $5.7 million at Hanford. We did not have any items in this category at Savannah River for 1957. I do not have the information here.

Mr. BOLAND. Do you need the $10 million for fiscal year 1958, then?

Mr. BLOCH. Based upon our past experience we think that we do. These requirements come up unexpectedly and are dependent many times on the complex of experiments and development work. Actually it looks as though there might be a requirement for as much as $20 million for this type of item. Our $10 million request represents our best judgment of what percentage of the total possibilities might be required to go forward this year.

GENERAL PLANT PROJECTS

Mr. BOLAND. Project 58 (1), you request $10 million in 1958. What was the level of expenditure in the last 2 years? That is general plant projects.

Mr. BLOCH. 1956 was $6.2 million. 1957 was $8.5 million. We are estimating $10 million for 1958. We have more plant in 1958 than in prior years.

Mr. BOLAND. Mr. Reporter, insert pages 254 through 258 under the special nuclear materials.

(The information follows:)

SPECIAL NUCLEAR MATERIALS PROGRAM, CONSTRUCTION OBLIGATIONS

Program statement

Estimated obligations, fiscal year 1958	$135,800,000
A. Obligations for new projects	(41,450,000)
B. Obligations for prior year projects	(94,350,000)
Estimated obligations, fiscal year 1957	46,740,000
Actual obligations, fiscal year 1956	43,004,105

Obligations for the special nuclear materials program for fiscal year 1958 are estimated at $135,800,000, of which $41,450,000 is for new projects justified in section A below which were authorized in the fiscal year 1958 authorization act. The balance of $94,350,000 is for projects listed under section B below which were authorized prior to fiscal year 1958 and for which funds have previously been appropriated but are now carried over into fiscal year 1958.

SECTION A

The projects comprising section A are as follows:

Project No.	Title	Total estimated cost	Obligations incurred through fiscal year 1957	Estimated obligations, fiscal year 1958	Funding required after fiscal year 1958 to complete project
58-b-1	Fabrication plant	$5,000,000	0	$5,000,000	0
58-b-2	Mechanical production line, Hanford, Wash.	1,500,000	0	1,500,000	0
58-b-3	Metal treatment plant, Fernald, Ohio	850,000	0	850,000	0
58-b-4	Improvements to production and supporting installations, Hanford, Wash., and Savannah River, S. C.	10,000,000	0	10,000,000	0
58-b-5	Additions to scrap plants, various sites	1,500,000	0	1,500,000	0
58-b-6	Additions to gaseous diffusion plants	6,600,000	0	6,600,000	0
58-b-7	Reduction of fire hazards, gaseous diffusion plants, Oak Ridge, Tenn., Paducah, Ky., and Portsmouth, Ohio.	12,000,000	0	6,000,000	$6,000,000
58-L	General plant projects	10,000,000	0	10,000,000	0
	Total	47,450,000	0	41,450,000	6,000,000

Explanation of projects in section A

1. *Project 58-b-1, fabrication plant, $5,000,000.*—This project provides for the construction of a facility which will be utilized in the manufacture of fuel elements. (Additional information of a classified nature is presented on p. 259.)

2. *Project 58-b-2, mechanical production line, Hanford, Wash., $1,500,000.*—This project provides for additions and modifications to an existing facility required to meet future workload, assure continuity of operations, improve contamination control, reduce maintenance costs, and improve operating efficiency. (Additional information of a classified nature is presented on p. 259.)

3. *Project 58-b-3, metal treatment plant, Fernald, Ohio, $850,000.*—Funds requested for this project will provide for a facility that will permit operating economies in the production of fuel elements. (Additional information of a classified nature is presented on p. 260.)

4. *Project 58-b-4, improvements to production and supporting installations, Hanford, Wash., and Savannah River, S. C., $10,000,000.*—This project provides for the design, procurement, fabrication, and installation of equipment and for modifications to present facilities and construction of new facilities at Hanford and Savannah River, necessary to permit continuity of operations, incorporation of technical advances, further increases in productivity, and increasing the safety of the various operations. (Additional information of a classified nature is presented on p. 260.)

5. *Project 58-b-5, additions to scrap plants, various sites, $1,500,000.*—This project provides for making certain additions to existing facilities located at the feed materials preparation sites. With increasing production, generation of scrap will continue to increase at the Fernald and St. Louis production plants. In addition to the current scrap generation, substantial stockpiles of scrap, some of quite a high grade and large amounts of low-grade scrap, will also be recovered. Economical operations require that the uranium be recovered from scrap when the cost of recovery is less than the price for virgin material.

6. *Project 58-b-6, additions to gaseous diffusion plants, $6,600,000.*—Funds requested for this project will provide for modifications to the recirculating water systems at the gaseous diffusion plants located at Oak Ridge, Paducah, and Portsmouth. (Additional information of a classified nature is presented on p. 261.)

7. *Project 58-b-7, reduction of fire hazards, gaseous diffusion plants, Oak Ridge, Tenn., Paducah, Ky., and Portsmouth, Ohio, $12,000,000.*—This project provides for certain modifications to gaseous diffusion plants and related auxiliary facilities at Oak Ridge, Paducah, and Portsmouth in order to reduce potential fire hazards and to minimize damage in the event of fire, thereby further insuring continued uninterrupted operation of the existing plants at their rated capacity. The proposed work will provide for modifications to roof construction, systems for

detecting, extinguishing, and protecting against fires in plants which were valued at approximately $3 billion on a replacement basis as of June 30, 1956. Several major industrial fires, including the fire which occurred in November 1956, at the AEC's Paducah plant, point up the vulnerability of AEC's major production facilities to fire.

8. *Project No. 58–L, general plant projects, $10,000,000.*—The work encompassed by this project consists of many miscellaneous improvements, alterations, additions, and retirements, including minor new construction. Similar work is performed annually in order to provide for continuity of operations, improvement in production techniques, elimination of health hazards, and reduction in operating costs in the various production plants and supporting facilities of the special nuclear materials construction program. Obligations in fiscal year 1957 will be approximately $8,555,000.

Since many of the items contained herein are recurring in nature, funds for those types of work are requested on the basis of past years' experience. Funds are also required for projects for which a need has been established on the basis of process improvements, technological advances, and experience gained from startup operations. The balance of the estimate is to provide for the many items that cannot be specifically identified in advance, although the need for similar items develops during each year's operations.

The estimate for this work in fiscal year 1958 is less than 1 percent of the capital value of all special nuclear materials plants under the jurisdiction of the Oak Ridge, Hanford, and Savannah River operations offices.

The amount requested for each operations office is as follows:

Operations office	*Amount*
Oak Ridge	$6,200,000
Hanford	2,500,000
Savannah River	1,300,000
Total	10,000,000

SECTION B

The projects comprising section B which have been previously authorized and for which funds have previously been appropriated but are now carried over into fiscal year 1958 are:

Project No.	Title	Total estimated cost	Obligations incurred through fiscal year 1957	Obligations to be incurred in fiscal year 1958
57–a–2	Improvements to reactor instrumentation, Hanford, Wash.	$7,985,000	$785,000	$7,200,000
57–a–3	Improved high-level waste-handling system, Savannah River.	4,500,000	0	4,500,000
57–a–4	Reactor facility safety improvement, Hanford, Wash.	4,990,000	2,490,000	2,500,000
57–a–5	Additional waste-disposal system, Hanford, Wash.	4,990,000	490,000	4,500,000
57–a–6	Charging and discharging system, Hanford, Wash.	3,450,000	0	3,450,000
57–a–7	Modifications to existing production facilities for increased efficiency and safety, Hanford, Wash.	2,950,000	2,310,000	640,000
5005	Additional chemical waste-storage facilities, Hanford, Wash.	4,600,000	1,300,000	3,300,000
5013	Alterations and additions to 100, 200, and 300 areas, Hanford, Wash.	13,000,000	11,540,000	1,460,000
5066	Expansion and additions to feed materials Facilities, various sites.	76,113,000	74,813,000	1,300,000
5209	Fabrication plant for fuel elements, site undetermined.	12,000,000	0	12,000,000
1017	Reactor products separations facilities, Savannah River, S. C.	296,974,000	281,098,000	15,876,000
1018	Feed materials production and testing facilities, Savannah River, S. C.	54,216,000	37,128,000	17,088,000
4070	Expanded production facilities, Oak Ridge, Tenn.	232,885,000	212,349,000	[1] 20,536,000
	Total	718,653,000	624,303,000	94,350,000

[1] Special procurement by GSA.

Additional information of a classified nature is presented on the following pages: 259 through 261.

(Discussion off the record.)

Mr. JENSEN. Did none of these items receive an appropriation last year? The table in section A shows zero for obligations in fiscal 1957.

Mr. FIELDS. Nothing was requested for these particular project numbers, Mr. Jensen. There was an appropriation for general plant projects, but it had a different project number.

Mr. JENSEN. It was under a different heading?

Mr. FIELDS. Yes, sir.

Mr. JENSEN. In each case?

Mr. FIELDS. In each of these cases for general plant projects. We did not request any money for the reduction of the fire hazard last year. These are construction projects, all of them.

Mr. JENSEN. I understand that.

Mr. FIELDS. There have been items for improvement, like 58 (b) (4) in the past for different types of improvement for these production facilities.

Mr. JENSEN. What will the level of your requests for 1957 in these items amount to? Are you asking for more money this year or about the same as you had last year?

Mr. FIELDS. I believe it is less money, Mr. Jensen.

Mr. JENSEN. The facts are that you did have money for each of these things last year under a different branch of your activity.

Mr. STRAUSS. Not each of them. For example, the fire hazard matter only came to have importance with us as a result of the fire at Paducah. Last year we did not spend any money on such a project.

Mr. JENSEN. So, that is a new request.

Mr. STRAUSS. Yes, sir.

Mr. JENSEN. That is all, Mr. Chairman.

WEAPONS PROGRAM—CONSTRUCTION OBLIGATIONS

Mr. BOLAND. We will now turn to the weapons section, and we will insert pages 262 to 269.

(The information follows:)

WEAPONS PROGRAM, CONSTRUCTION OBLIGATIONS

Program statement

Estimated obligations, fiscal year 1958	$71,084,000
A. Obligations for new projects	(43,531,000)
B. Obligations for prior year projects	(27,553,000)
Estimated obligations, fiscal year 1957	66,281,000
Actual obligations, fiscal year 1956	48,863,306

Obligations for the weapons program for fiscal year 1958 are estimated at $71,084,000, of which $43,531,000 is for new projects justified in section A below which were authorized in the fiscal year 1958 authorization act or were previously authorized and for which a request for appropriation was deferred until fiscal year 1958. The balance of $27,533,000 is for projects listed under section B below which were authorized prior to fiscal year 1958 and for which funds have previously been appropriated but are now carried over into fiscal year 1958.

SECTION A

The projects comprising section A are as follows:

Project No.	Title	Total estimated cost	Obligations incurred through fiscal year 1957	Estimated obligations, fiscal year 1958	Funding required after fiscal year 1958 to complete project
58-c-1	*Weapons products and development plant.*	*$10,000,000*	*0*	*$10,000,000*	*0*
58-c-2	Weapons special component plant	6,000,000	0	6,000,000	0
58-d-1	Manufacturing plant expansion, Albuquerque, N. Mex.	3,325,000	0	3,325,000	0
58-d-2	Storage site modifications	2,000,000	0	2,000,000	0
58-d-3	High explosive development plant, Livermore, Calif.	2,100,000	0	2,100,000	0
58-d-4	Engineering and laboratory building, Los Alamos, N. Mex.	1,013,000	0	1,013,000	0
58-d-5	Ventilation system replacements, Los Alamos, N. Mex.	618,000	0	618,000	0
58-d-6	Reclamation foundry, shop, and warehouse, Sandia Base, N. Mex.	308,000	0	308,000	0
58-d-7	Reactor, area III, Sandia Base, N. Mex.	2,900,000	0	2,900,000	0
58-d-8	Base construction, Nevada test site	350,000	0	350,000	0
58-d-9	Base construction, Eniwetok proving ground.	7,917,000	0	7,917,000	0
58-L	General plant projects	7,000,000	0	7,000,000	0
	Total	43,531,000	0	43,531,000	0

EXPLANATION OF PROJECTS IN SECTION A

1. *58-c-1 Weapons production and development plant, various locations, $10,000,000.*—It is expected that the rapid development and changes in weapons technology will generate needs for development, test, production, and assembly plants which cannot now be clearly foreseen. Such requirements have arisen in the past and are expected to continue in fiscal year 1958. The continuation of progressive development, testing, and production of new-type devices and weapons and the successful exploitation of research findings will depend upon capability to expand or add additional plants.

In fiscal year 1957 a similar project made it possible to expand production plants and research and development facilities at various locations, e. g., manufacturing space at Kansas City, Mo., and developmental space at Livermore, Calif. A similar project in fiscal year 1956 made it possible to proceed with a facility at Rocky Flats, and an expansion of test facilities at Sandia Base.

Since this project is of contingent nature, no breakdown of specific cost is available.

2. *58-c-2 Weapons special component plant, location undetermined, $6,000,000.*—This project provides for the construction of a plant for the production of special equipment. The plant will be of standard light industrial-type construction.

(Additional information of a classified nature is presented on p. 270.)

3. *58-d-1 Manufacturing plant expansion, Albuquerque, N. Mex., $3,325,000.*—This project provides for additional plant capacity at the ACF Industries, Inc., South Albuquerque Works. The expansion is planned to begin in October 1957 for completion by September 1958 and consists of:

(*a*) Addition of two manufacturing bays (66,650 square feet) of rigid steel frame, concrete slab construction with corrugated metal siding.

(*b*) Construction of 50,000 square feet two-story engineering and office building, remodeling of present space into a small machine shop, and to provide a cafeteria seating 400 persons.

(Additional information of a classified nature is presented on p. 270.)

4. *58-d-2 Storage site modifications, various locations, $2,000,000.*—This project provides for capital improvements, additions, and modifications to facilities at weapons storage sites.

(Additional information of a classified nature is presented on p. 271.)

5. *58–d–3 High explosive development plant, Livermore, Calif., $2,100,000.*—To provide a testing facility in support of the weapons program being conducted at the University of California Radiation Laboratory (UCRL), land was procured in the Livermore vicinity in fiscal year 1955 and facilities (development facilities I) were constructed at a cost of $850,000. During fiscal year 1957 additional facilities (development facilities II) were initiated at an estimate of $1,200,000 to continue the buildup of the site testing facilities.

The need has developed for the expansion and the installation of additional specialized development facilities in fiscal year 1958. Due to the rapid developments of the program, an expanded capacity is required.

In locating the new facilities, additional land must be acquired to observe safety distances from existing facilities and from the site border.

Construction will begin early in fiscal year 1958 and will be completed in December 1958.

(Additional information of a classified nature is presented on p. 272).

6. *58–d–4 Engineering and laboratory building, Los Alamos, N. Mex., $1,013,000.*—This project consists of a three-story, 22,000-square-foot reinforced concrete building which will provide a test laboratory and engineering and administrative space. This laboratory is required to meet the laboratory program changes and growth. The building will be located in one of the remote technical areas at Los Alamos which is devoted to the engineering, design, development, and testing of nuclear materials and components.

Construction will begin in September 1957 and will be completed in October 1958.

(Additional information of a classified nature is presented on p. 272).

7. *58–d–5 Ventilation system replacements, Los Alamos, N. Mex., $618,000.*—This project provides for an additional ventilation system for four process buildings located at Los Alamos. These buildings were constructed in 1945 as temporary structures and the ventilation system installed provided for the exhaustion of process activities such as dry boxes, fume hoods, etc., as well as interior building exhaust air. Significant process changes have been made in the past 10 years which have placed such heavy demands on the existing system that it is strictly substandard and the exhaust air contains an uncontrollable level of radioactivity. The present system has also had numerous additions and alterations and is beyond the point of further safe modification.

It is proposed to disconnect the existing exhaust system from the process equipment and have it serve to exhaust only the uncontaminated and noncorrosive room air from the laboratories. The new ventilation system will be installed to service only the exhaust-producing laboratory equipment. Air thus exhausted will be collected in filter stations and passed through high efficiency filters and discharged through 40- to 50-foot stacks. Since the 100,000 cubic feet per minute of exhaust air obtained from processes (which is the source of most of the radioactive waste) will then be kept concentrated, it will permit the use of fewer high efficiency exhaust filters than would be the case if the 250,000 cubic feet per minute of the present system had to be thus filtered.

Primary absorbers will be located at the outlet side of the laboratory equipment to remove most of the corrosive particles and thus reduce the need for extensive stainless-steel ductwork. Two filter houses, each servicing two buildings, will be required. In addition, change house facilities necessary to protect personnel engaged in replacing contaminated filters will be necessary at the filter stations. Work will begin in July 1957 and will be completed in December 1958.

8. *58–d–6 Reclamation foundry, shop, and warehouse, Sandia Base, N. Mex., $308,000.*—This project is required to replace facilities which are no longer adequate and constitute fire hazards. This construction will provide an 18,500-square-feet reinforced concrete building to house the metal reclamation activity conducted at Sandia Base. This function requires a foundry, machine shop, and storage area for the handling of classified shapes prior to reclamation.

The present foundry is located in an unsprinklered Butler-type building which will not meet the required capacity and is a fire hazard. The shop and storage activities are now located in a building originally designed for warehousing. This building is too small for both activities as well as being unsuitable for shopwork. It is planned to again utilize this buildling as a storage warehouse.

The consolidation of the reclamation activity and the provision of adequate working area for the foundry, shop, and storage functions will give Sandia the capability of adequately handling material for reclamation. Construction will begin in September 1957 and will be completed in June 1958.

9. *58–d–7 Reactor, area III, Sandia Base, N. Mex., $2,900,000.*—This project provides for a 23,000-square-feet concrete structure to house a 5,000-kilowatt reactor and associated laboratory space, including procurement and installation of the reactor.

(Additional information of a classified nature is presented on p. 273).

10. *58–d–8 Base construction, Nevada test site, $350,000.*—This project provides for miscellaneous plant improvements at the Nevada test site and includes modifications and minor additions to structures and technical facilities required in the conduct of full-scale test operations. Each year a minimum level of such improvements are found to be necessary to assure effective operation of the test site. Examples of known requirements for fiscal year 1958 are a rad-safe building, waterlines to the control point, a loading dock and fencing at the control point, an addition to the motor maintenance building and expansion of the sewerage plant.

This project is scheduled to start in July 1957 and to be completed in June 1958.

11. *58–d–9 Base construction, Eniwetok proving ground, $7,917,000.*—This project includes the construction of base facilities at Eniwetok and Parry Islands which are considered necessary to the safe and efficient accomplishment of test operations.

(Additional information of a classified nature is presented on p. 274.)

12. *58–L General plant projects, $7,000,000.*—This project consists of miscellaneous improvements, alterations, additions and retirements, including minor new construction and is a consolidation of projects required in the operation of production, research and development, and minor facilities of the weapons program. Changes in production requirements and developmental programs will necessitate plant modification and alterations as well as new minor technical facilities.

Changes will be required to meet operating deficiencies and to improve processes to take advantage of technological advances and experience. Many of the items contained are known projects. There is also included provision for minor modification to roads, utilities and other miscellaneous work which are required in a changing program and in order to maintain facilities at necessary levels of operating efficiency. Estimate by operations office is as follows:

Albuquerque Operations Office	$4, 500, 000
San Francisco Operations Office	2, 500, 000
Total	7, 000, 000

SECTION B

The projects comprising section B which have been previously authorized and for which funds have previously been appropriated but are now carried over into fiscal year 1958 are:

Project No.	Title	Total estimated cost	Obligations incurred through fiscal year 1957	Obligations to be incurred in fiscal year 1958
57–b–1	Area 5 expansion	$20, 900, 000	$19, 513, 000	$1, 387, 000
57–b–2	Weapons assembly plants	14, 543, 000	6, 483, 000	8, 060, 000
57–b–3	Weapons production and development plant	18, 314, 000	17, 155, 000	1, 159, 000
57–b–4	Weapons development and engineering facilities, Livermore, Calif.	11, 850, 000	2, 950, 000	8, 900, 000
57–f–1	Metallurgy Laboratory, Livermore, Calif.	2, 270, 000	0	2, 270, 000
57–f–3	High explosive and weaponizing plant, Livermore, Calif.	1, 100, 000	423, 000	677, 000
56–f–3	New Sigma Laboratory, Los Alamos, N. Mex.	5, 100, 000	0	5, 100, 000
	Total	74, 077, 000	46, 524, 000	27, 553, 000

Mr. BOLAND. Mr. Fields, will you give us a summary of this section?

Mr. FIELDS. Mr. Chairman, in this program we are asking for new projects in the amount of $43,531,000. This is identical to the authorization that was requested of Congress and passed by the House last Friday.

58–C–1 WEAPONS PRODUCTION AND DEVELOPMENT PLANT

The first item is weapons production and development plant in the amount of $10 million. This is for facilities that would be built at different installations. We have found that there is a need in the rapidly developing field of weapons to have what amounts to an authority of a continuing nature in order to move rapidly toward the construction of special facilities. Your committee has seen fit to give us appropriations for this kind of an item for the past 3 or 4 years. It would be utilized for the provision for facilities when an urgent need arises during the course of a fiscal year.

58–C–2 WEAPONS SPECIAL COMPONENTS PLANT

The second item, the weapons special components plant, is a $6 million item which is to provide a plant for the production of a very special component which development in the past has shown is a very desirable feature to add to weapons. This would permit the construction of a second source for the production of that particular component. It is a necessary part of the weapons program.

58–D–1 MANUFACTURING PLANT EXPANSION

The third item, the manufacturing plant expansion, Albuquerque, N. Mex., in the amount of $3,325,000, is to allow for the expansion of the plant operated for us by the American Car & Foundry Industries in Albuquerque. This plant has been in operation for at least 5 years and needs increased facility for the production that is carried on there.

58–D–2 STORAGE SITE MODIFICATIONS

The next item is the storage site modification in the amount of $2 million and is for capital improvements and additions to the various storage sites that are operated and maintained by us for the storage of a good part of the national stockpile.

58–D–3 HIGH EXPLOSIVE DEVELOPMENT PLANT

The next item is for the construction of a testing facility in the amount of $2,100,000—a high explosive development plant at Livermore, Calif. This new facility would be located adjacent to an existing one which we do have to expand. We conduct actual high explosive firings, not of large size, but of developmental size, for the perfection of the development of the weapons. Additional land would be required for the expansion of this site.

58–D–4 ENGINEERING AND LABORATORY BUILDING

The next item is an engineering and laboratory building at Los Alamos, N. Mex., This project will provide an additional test laboratory and engineering space.

58–D–5 VENTILATION SYSTEM REPLACEMENTS

Another item for Los Alamos is ventilation system replacements, a requirement with respect to one of the facilities there.

58–D–6 RECLAMATION FOUNDRY, SHOP AND WAREHOUSE

This item is required at the Sandia base for the support of the engineering development carried on by the Sandia Corp. for us.

58–D–7 REACTOR

The following item, a reactor in the amount of $2.9 million, is also to be located at Sandia base.

58–D–8 BASE CONSTRUCTION

The next two items have to do with the construction at the Nevada test site, and at the Eniwetok Proving Ground. The first is in the amount of $350,000 and is for miscellaneous construction for the improvement of the Nevada test site, with certain minor modifications to structures and technical facilities.

58–D–9 BASE CONSTRUCTION

The item for Eniwetok is in the amount of $7,917,000 and involves construction at Eniwetok, at Perry Islands, of facilities for the conduct and maintenance of the proving ground. It involves improvements to the airfield in the amount of $3.3 million, as well as to the power and water production plant.

GENERAL PLANT PROJECTS

Here again we have a general plant project in the amount of $7 million that we are requesting for the provision of minor modifications to roads and utilities and other miscellaneous work associated with the facilities in the production program.

Mr. Chairman, you may wish specific details with respect to some of these projects.

58–C–1 WEAPONS PRODUCTION AND DEVELOPMENT PLANT

Mr. BOLAND. How about the level of expenditures on project 58–c–1, for the last 2 years. These are sort of catchall items.

Mr. FIELDS. Last year there was an authorization and appropriation of $15 million. In 1956 this item was $20 million.

Mr. BOLAND. What were the expenditures?

Mr. FIELDS. General Starbird will answer.

General STARBIRD. Over $22 million for fiscal 1956. For fiscal year 1957 it appears to be $17 million.

GENERAL PLANT PROJECTS

Mr. BOLAND. Item 58 (1), would you give us the same explanation?

Mr. MCCARTHY. $5,720,000 were the 1957 obligations.

Mr. BOLAND. How about 1956?

Mr. MCCARTHY. 1956 was $5,102,000.

Mr. BOLAND. What was actually spent?

Mr. MCCARTHY. In 1956 the actual expenditures against those projects was $2.5 million and the balance of $3 million was spent in 1957. The costs run over a 2-year period.

Mr. BOLAND. It has been increased considerably, has it not, for 1958? Why do you have such a high increase?

Mr. MCCARTHY. Additional plants coming into being require taking care of. You have these items from previous years which are in construction and you have the recurring needs in the various plants. The amount is an experience figure for each of the various programs as to the amount of plant in being and the various needs that arise during the year. In total the authorization bill carries this item as $26 million. You will note that we have broken it down under each program here. In 1957 the total authorization was $23 million, I believe. So in total it is a $26 million item for 1958.

REACTOR DEVELOPMENT PROGRAM—CONSTRUCTION OBLIGATIONS

Mr. BOLAND. We will turn to reactor development and we will insert pages 275 through 290 in the record.

(The information follows:)

REACTOR DEVELOPMENT PROGRAM, CONSTRUCTION OBLIGATIONS

Program statement

Estimated obligations fiscal year 1958	$179,197,000
A. Obligations for new projects	(126,246,000)
B. Obligations for prior year projects	(52,951,000)
Estimated obligations fiscal year 1957	105,264,000
Actual obligations fiscal year 1956	60,005,000

Obligations for the reactor development program for fiscal year 1958 are estimated at $179,197,000 of which $126,246,000 is for new projects justified in section A below which were authorized in the fiscal year 1958 authorization act or were previously authorized and for which a request for appropriation was deferred until fiscal year 1958. The balance of $52,951,000 is for projects listed under section B below which were authorized prior to fiscal year 1958 and for which funds have previously been appropriated but are now carried over into fiscal year 1958.

SECTION A

The projects comprising section A are as follows:

Project No.	Title	Total estimated cost	Actual obligations through fiscal year 1957	Estimated obligations, fiscal year 1958	Funding required after fiscal year 1958 to complete project
58-e-1	Power reactor development acceleration project.	$11,500,000	0	$11,500,000	0
58-e-2	Puerto Rico power reactor	9,000,000	0	9,000,000	0
58-e-3	Fuels Technology Center, Argonne National Laboratory, Ill.	10,000,000	0	10,000,000	0
58-e-4	Modification and additions, aircraft nuclear propulsion ground test plant, area No. 1, National Reactor Testing Station, Idaho.	8,000,000	0	8,000,000	0
58-e-5	Test installations for classified project	9,000,000	0	2,500,000	$6,500,000
58-e-6	Project Sherwood plant	7,750,000	0	5,000,000	2,750,000
58-e-7	Waste calcination system, National Reactor Testing Station, Idaho.	4,000,000	0	4,000,000	0
58-e-8	Hot cells	3,500,000	0	3,500,000	0
58-e-9	High-temperature test installation, Bettis plant, Pennsylvania.	3,000,000	0	3,000,000	0
58-e-10	Destroyer reactor development plant, KAPL.	750,000	0	750,000	0
58-e-11	Sodium reactor experiment modifications, Santa Susana, Calif.	4,700,000	0	500,000	4,200,000
58-e-12	Liquid metal fuel reactor experiment	17,500,000	0	2,000,000	15,500,000
58-e-13	Argonne boiling reactor	8,500,000	0	8,500,000	0
58-f-1	Waste storage tanks, National Reactor Testing Station, Idaho.	3,700,000	0	3,700,000	0
58-f-2	Hot pilot plant	2,000,000	0	2,000,000	0
58-f-3	Land acquisition, National Reactor Testing Station, Idaho.	1,000,000	0	1,000,000	0
58-1	General plant projects	5,000,000	0	5,000,000	0
58-111	Cooperative power arrangements project.	44,275,000	0	38,296,000	5,979,000
57-e-3	Modifications and expansions of ANP ground-test facilities, area No. 1, Idaho.	15,000,000	[1] 10,000,000	[2] 5,000,000	0
56-b-6	ANP program plant and test area, Arco, Idaho.	13,000,000	[3] 10,000,000	[4] 3,000,000	0
	Total	181,175,000	20,000,000	126,246,000	34,929,000

[1] Of this amount, $1,350,000 is carried over into fiscal year 1958. (See sec. B, p. 290.)
[2] In addition, $1,350,000 will be obligated from funds carried over from fiscal year 1958 as indicated in sec. B.
[3] Of this amount, $8,700,000 is carried over into fiscal year 1958. (See sec. B, p. 290.)
[4] In addition, $8,700,000 will be obligated from funds carried over from fiscal year 1958 as indicated in sec. B.

Explanation of projects in section A

1. *Project 58-e-1 Power reactor development acceleration project, $11,500,000.*—This project provides for construction as may be required to expand the research and development programs aimed at advancing civilian reactor technology. The Commission has been pursuing an experimental program of research and development on different reactor concepts suitable for use in the production of economically competitive nuclear power. Several new construction items are required to keep the experimental program going at an accelerated rate. Additional needs are expected to develop as work progresses for buildings and capital equipment for reactor experiments already underway. Also, there will be construction requirements for promising new reactor concepts, on which experimental work has been initiated in prior years. It is anticipated that facilities required in fiscal year 1958 may include buildings and building modifications, other engineering, development, laboratory, research, and experimental construction requirements.

2. *Project 58-e-2 Puerto Rico power reactor, $9,000,000.*—This project consists of the combined design, construction, and test operation of a demonstration nuclear powerplant to be located in Puerto Rico—either on Government-owned land or under suitable lease arrangement. The total projects provide for a complete powerplant, including of water-cooled, water-moderated heterogeneous reactor in the 15 to 20 MWE range; heat exchanger; turbine generator; shield; and instrumentation and accessory equipment.

The power reactor will be constructed for the Government of Puerto Rico as a part of the program to promote the peaceful uses of atomic energy in the Latin American countries as authorized by the Atomic Energy Act of 1954. This plant will demonstrate the feasibility of such future plants and will be used as a training facility. It is expected that the AEC would enter into an agreement with the Water Resources Authority of Puerto Rico, which would share in the cost of plant construction. A ceiling of $10 million is to be assigned to total plant capital costs. The AEC will contribute $9 million and the Authority $1 million; if costs are less than $10 million, the AEC and the Authority will contribute 90 percent and 10 percent, respectively.

3. Project 58–e–3 Fuels Technology Center, Argonne National Laboratory, $10,000,000.—This project provides for the construction of a center at the Argonne National Laboratory especially designed and built to permit "cold" plutonium and irradiated "hot" plutonium handling in large quantities without undue hazard. It will consist of one building, located in the west area, of reinforced concrete structural frame with exterior walls of face brick with concrete block backup. The building will have a gross area of about 220,000 square feet which will include 1- and 2-story space, high bay areas, and the necessary special equipment space. The major cost will result from design specifications required for plutonium-handling areas. These areas will not replace or duplicate any existing plutonium laboratory at the Argonne National Laboratory.

The proposed building will house facilities for fundamental and basic research on the metallurgy of plutonium and other materials; the ceramics of uranium, thorium, and other materials; and the technology of solid and liquid nuclear reactor fuels. These facilities will be used to carry out a broad and essential program of research and development on plutonium, plutonium alloys, and other alpha active materials. In the near future, ceramics and plutonium metallurgy will be of increasing importance; the metallurgy and ceramic facilities presently in use or under construction were primarily designed for uranium work. The proposed center will maintain a manpower effort not less than 50 percent in advancing plutonium technology.

4. Project 58–e–4 Modification and additions, aircraft nuclear propulsion ground test plant, area No. 1, National Reactor Testing Station, Idaho, $8,000,000.—This project provides for increased development test capability required by the aircraft nuclear propulsion program at the National Reactor Testing Station, Idaho. The project contemplates additions and modifications to existing facilities.

Additional information on this project is contained on classified page 291.

5. Project 58–e–5 Test installations for classified project, $2,500,000.—This project provides for the design and construction of facilities necessary to determine the experimental feasibility of a classified project.

Additional information on this project is contained on classified page 292.

6. Project 58–e–6 Project Sherwood plant, $5,000,000.—Several decisions concerning the assembly of larger experimental models and their supporting facilities in the controlled thermonuclear program are pending until smaller models have been successfully operated and certain technical and theoretical problems have been resolved. Since these developments cannot be foreseen, this project provides $5 million for the construction of supporting facilities whenever necessary at the several sites where controlled thermonuclear research is in progress.

Additional information on this project is contained on classified page 293.

7. Project 58–e–7 Waste calcination system, National Reactor Testing Station, Idaho, $4,000,000.—This project provides for the construction of a system for reducing all chemical processing plant liquid wastes containing fission products to a dry state, followed by storage of the solids. It will be located adjacent to the waste-storage area and will comprise several shielded hot cells containing calcination equipment; operating area; handling and storage areas for solid wastes; and necessary appurtenant utilities, piping, site development, etc.

Hot waste solutions are currently stored in costly, underground stainless steel tanks. Storage of this waste cannot be considered permanent because of long-term corrosion and the long half-life of the fission products. The advent of zirconium and stainless steel containing fuels for military and power reactors will increase the quantity of waste and intensify the corrosion. This facility will reduce the costs of storing wastes, enable permanent storage of wastes where long half-life materials are involved, reduce the quality and the quantity of the storage tanks required, aid in the reduction of overall processing costs for fuel reprocessing, and provide fission products in a form easily usable for indus-

trial concerns. Most important of all, storage of solid oxide forms of waste fission products is much less hazardous than the storage of highly corrosive liquid wastes.

8. *Project 58–e–8 Hot cells, $3,500,000.*—This project provides for the construction of hot cells at AEC laboratory locations. These cells will be located in appropriate buildings with steel framing, reinforced concrete floors, metal roof panels, and builtup roof. Exterior walls will be of masonry; concrete block partitions will be provided in the heavy work area; and normal building and laboratory services and utilities will be provided as well as adequate fire protection. Each cell will be stainless steel lined, constructed of high density concrete with 4-foot walls, and equipped with manipulators and high-density viewing windows. The operating side of the hot-cell areas will be air-conditioned and the cells will be properly ventilated. Also included will be normal laboratories for making appropriate control studies, special provisions required for removal of decontaminated materials, and an underfloor shielded dry storage area.

The ability to irradiate samples now far exceeds the Nation's ability to make appropriate postirradiation studies. Probably the most important and yet least understood phase of reactor technology is the effect of radiation on the materials of reactor construction, particularly when combined with high temperature and/or circulating fuels. The reactor development program will reach the stage by fiscal year 1960 where major attention must be focused without further delay on the effect of irradiation on reactor materials behavior. Large numbers of hot cells suitably sized, designed, and equipped are required for the study of these radiation effects.

9. *Project 58–e–9 High temperature test installation, Bettis plant, Pennsylvania, $3 million.*—This project provides for the construction of a high-temperature test installation to be used for nuclear core experiments. It includes a pressure vessel suitable for the insertion of a wide variety of critical assemblies and the performance of water moderated nuclear experiments at temperatures up to 500° F. Also included is a dynamic loop for the performance of nuclear experiments under transient thermal conditions.

To date, all critical assembly experiments for pressurized water reactors have been conducted at room temperature. Inability to obtain accurate elevated temperature nuclear design data by present analytical and experimental techniques seriously handicaps the development and improvement of pressurized water reactors, delays the firming up of design data, and involves extra cost. The proposed project will serve an invaluable function in alleviating this condition. The requirement for obtaining more accurate core design information creates an urgent need for this facility.

10. *Project 58–e–10 Destroyer reactor development plant, Knolls Atomic Power Laboratory, New York, $750,000.*—This project provides for site work and the construction of buildings, utilities, and appurtenances required to support research and development, including housing for critical experiments in connection with the destroyer reactor project. The plant will be located at the Knolls Atomic Power Laboratory, New York.

Late in 1955, the Department of Defense established a requirement for a nuclear propulsion plant of small size and weight suitable for lightweight naval vessels such as destroyers. In early fiscal year 1957 various types of reactors were investigated for this application, with the pressurized water reactor finally being selected as the cycle which promised reasonable assurance of meeting the urgent requirement. Research and development to advance and extend pressurized water technology for this application has been initiated in fiscal year 1957. Subsequent development effort may include detailed investigation of reactor core physics and materials, critical experiments to verify the core nuclear characteristics, and design of pumps, valves, heat exchangers, and other nuclear components.

11. *Project 58–e–11 Sodium reactor experimental modifications, Santa Susana, Calif., $500,000.*—This project provides for modifications and improvements to the sodium graphite reactor experiment (SRE) located at Santa Susana, Calif. It provides for component modifications to incorporate engineering improvement for better performance and improved operating economy. Included will be the removal and replacement of the moderator assembly, removal, and replacement of other components, modification or replacement of instrumentation and control devices, and the construction of a sodium flushing system to prepare the SRE for modification work. It will also be necessary to provide solid-waste storage.

This project is required to further develop the sodium graphite reactor concept. It will permit additional development work on components of the SRE, and the development of new components incorporating new knowledge subsequently obtained from experimentation. The actual timing of this modification work will depend largely upon operating experience with the SRE as currently designed.

The total estimated cost of this project is $4,700,000. The balance will be included in future budgets.

12. *Project 58–e–12 Liquid metal fuel reactor experiment, site undetermined, $2,000,000.*—This project provides for the construction of an experimental reactor and auxiliary facilities at a site to be designated by the Commission. It is contemplated that the reactor, using the liquid metal fuel concept, will develop approximately 20 million watts of heat. No electrical generating capacity is planned. A building to house the reactor will be required which will also include component cells, shielding, control space, and utilities.

This project forms the most important part of the liquid metal fuel reactor work initiated in fiscal year 1956. Original component development studies indicated that this type of reactor is feasible for civilian use and gives promise of achieving low-cost electrical power. This experimental reactor is required as a flexible development tool to advance the technology of the liquid metal fuel concept to a point where a large-scale application can be considered.

Total estimated cost of this project is $17,500,000. The balance will be included in future budgets.

13. *Project 58–e–13 Argonne boiling reactor (Arbor), National Reactor Testing Station, Idaho, $8,500,000.*—This project provides for the construction of a reactor designed as a flexible unit capable of generating in the order of 200 megawatts of heat at saturated steam pressure between 600 and 2,000 pounds per square inch gage. The project will be located at the National Reactor Testing Station. Detailed specifications of reactor size of the boiling water concept and coolant circuits are subject to results of further design analysis. It is contemplated that the reactor vessel will be about 9 feet in diameter and 41 feet in length. The vessel will accommodate cores up to 6 feet in diameter and 6 feet high. Consideration will also be given to modifying the reactor for operation with heavy water, and two types of heat exchangers will be used. Control of the reactor will be effected from an adjacent control bunker, although all components will be sufficiently shielded to permit limited access during operation. Thorough coverage by instrumentation will be provided for compilation of data.

Several large central station powerplants utilizing a boiling water heat source are under design study at the present time. The information used as a basis for design is largely theoretical; this is insufficient for optimum design of large size high pressure and power units. Only actual reactors operating under prescribed conditions can satisfactorily resolve questions about the effects of the many parameters on boiling water performance. The Arbor facility will be designed to provide experimental data for the resolution of many of these design problems.

14. *Project 58–f–1 Waste storage tanks, National Reactor Testing Station, Idaho, $3,700,000.*—This project provides for the design, construction, and installation of 3 additional 300,000 gallon tanks (with cooling coils to contain first cycle wastes) and 1 additional 300,000 gallon uncooled tank (to contain second and third cycle wastes) at the National Reactor Testing Station, Idaho. Also to be constructed with the tanks will be a control house to operate the cycling of the wastes.

These tanks will provide additional storage capacity for liquid wastes to be generated by the processing of scheduled spent fuel elements to be made available to the CPP. Since tank construction normally requires about 18 months, this project must cover additional tank requirements through mid-fiscal year 1960. Under current policy, to prevent contaminating the area in the event of leakage, one uncooled tank is retained empty as a spare.

15. *Project 58–f–2 Hot Pilot Plant, National Reactor Testing Station, Idaho, $2,000,000.*—This project provides for the construction of a plant at the National Reactor Testing Station especially designed and built to permit test processes on a pilot plant scale with highly irradiated materials. It will consist of one building, located adjacent to related chemical processing plants, of about 4,300 square feet, with building height of 50 feet—part of which will be below ground. The building will consist of 4 levels, within which 4 heavily shielding cell units will be contained. Cells will generally be stainless steel lined and will be equipped with all necessary services so that maximum flexibility will

be obtained. A solution preparation and feed area will be located on top of the cell area. A bridge crane will be installed over the cells to handle plugs and carriers, and for installation and removal of equipment.

Fuel processing programs during recent years have necessitated extensive new processing development work. Considerable experimental effort is required to aid in the solution of major processing problems related to existing fuel types as well as the processing of new military and civilian power reactor fuels. In radiochemical process work, it is generally impossible to extrapolate from "hot" laboratory or "cold" pilot plant investigations directly to "hot" plant-scale processes with much certainty as to process workability. Provision for "hot" pilot plant investigations will fill the present gap.

16. *Project 58–f–3 Land acquisition, National Reactor Testing Station, Idaho, $1,000,000.*—This project provides for the acquisition of approximately 149,700 acres of additional land for the National Reactor Testing Station by extending the limits 6 miles north, one-half mile to the northeast, and 7 miles east of the present boundary for that portion of the NRTS north of United States Highway No. 20.

It is necessary to acquire additional land to the north, northeast, and east of the present NRTS boundary for protection of the inhabitants' health and safety. With the concentration of the ANP facilities at the north end of the station, the possibility of contamination from wastes released into the atmosphere will increase to a point that endangers the health and safety of inhabitants within the proposed project area. A similar situation will exist in the southeast portion of NRTS with the concentration of excursion-type reactors and EBR II in that vicinity. In the overall best interests of the AEC future program at NRTS, it is imperative that this area of land be withdrawn from public habitation. Rerouting Idaho Highways 22 and 28 will not be necessary as the same type of controls currently utilized on U. S. Highway 20 will be exercised on the roads at the north end of the NRTS.

17. *Project 58–1 General plant projects, $5,000,000.*—This project provides for minor alterations, improvements, additions, or new construction for facilities under the Chicago, Idaho, and Schenectady Operations Offices. This estimate is based on experience in prior years, age, and conditions of the facilities, other work planned for the facility, and any special needs which are apparent. The estimate is for the following requirements for each operations office:

Chicago	$3,500,000
Idaho	1,000,000
Schenectady	500,000
Total	5,000,000

18. *Project 58–111 Cooperative power arrangement project, $38,296,000.*—This project provides for construction of reactor portions of demonstration nuclear powerplants through various arrangements with participant public utilities under the cooperative power arrangement program, as follows: A large-scale sodium graphite reactor for Consumers Public Power District; an advanced small capacity boiling water reactor for the Rural Cooperative Power Association; a small capacity homogeneous reactor for Wolverine Electric Cooperative Association; an organic cooled and moderated reactor for the city of Piqua; and a sodium cooled, heavy water moderated reactor for Chugach Electric Association.

The purpose of this project is for the AEC to provide for the construction of five nuclear reactors and related facilities by direct contract with equipment manufacturers or engineering organizations. The Commission will also contract directly with the cooperative or publicly owned organizations with respect to the provision of a site and conventional turbogenerating facilities. These reactors will be used in the operation of demonstration nuclear powerplants.

19. *Project 57–c–3 Modifications and expansions of ANP ground test facilities, area No. 1, NRTS, Idaho, $5 million.*—This project provides for construction of modifications to and expansion of ANP ground test facilities at the NRTS, area No. 1, essential to the program of the United States Air Force and the AEC for the development of aircraft nuclear propulsion systems. The project was authorized by Public Law 506, 84th Congress. Total estimated cost of the project is $15 million of which $10 million has been made available in prior years.

Additional information on this project is contained on classified page 294.

20. *Project 56–b–6 Aircraft nuclear propulsion program plant and test area, Arco, Idaho, $3 million.*—This project provides for the construction, at the NRTS, Idaho, of test facilities for the ground testing of a prototype aircraft nuclear

propulsion system, and is a part of the ANP area No. 1 test facilities. Total estimated cost of the project is $13 million, of which $10 million has been made available in prior years. An appropriation in fiscal year 1958 of $3 million is required for completion of the project. This project was authorized by Public Law 141, 84th Congress.

Additional information on this project is contained on classified page 294a.

SECTION B

The projects comprising section B which have been previously authorized and for which funds have previously been appropriated but are now carried over into fiscal year 1958 are:

Project No.	Title	Total estimated cost	Actual obligations through fiscal year 1957	Obligations to be incurred in fiscal year 1958	Funding required after fiscal year 1958
57-c-2	Research and developmental test plant	$25,000,000	$9,265,000	$5,735,000	$10,000,000
57-c-3	Modifications and expansions of ANP ground test facilities, area No. 1, Idaho.	[1]	0	1,350,000	0
57-c-6	Food irradiation facility	3,000,000	0	3,000,000	0
57-c-7	Project Sherwood plant	2,000,000	658,000	1,342,000	0
57-c-9	MTR hot cell extension, NRTS	310,000	40,000	270,000	0
57-g-1	Addition to electrical power system, NRTS.	3,800,000	2,200,000	1,600,000	0
xxx	Nuclear-powered merchant ship authorized.	17,000,000	11,000,000	6,000,000	0
56-b-1	Power reactor development acceleration project.	887,000	837,000	50,000	0
56-b-2	Fast power breeder pilot facility (EBR-II).	29,100,000	3,000,000	11,850,000	14,250,000
56-b-3	Surface ship reactor facility	35,000,000	25,000,000	10,000,000	0
56-b-4	Submarine advanced reactor facility	23,140,000	21,086,000	2,054,000	0
56-b-6	ANP program plant and test area, Arco, Idaho.	[1]	0	8,700,000	0
56-g-6	Research reactor, Philippine Government.	500,000	0	500,000	0
445-4002	Reactor room compartment, SIR, Mark B.	19,500,000	19,000,000	500,000	0
	Total	[2] 169,287,000	92,086,000	52,951,000	24,250,000

[1] See sec. A.
[2] Includes $10,050,000 for projects 57-c-3 and 56-b-6, which are described in sec. A.

Mr. BOLAND. Mr. Fields, will you give us a statement on that?

Mr. FIELDS. Yes, sir. We are requesting appropriations for obligations for new projects in the amount of $126,246,000. That figure does include, however, $9 million for a Puerto Rican reactor which was not included in the authorization bill as passed by the House. So that amount would have to be decreased by that $9 million. It does include money for cooperative power arrangements.

POWER REACTOR DEVELOPMENT ACCELERATION PROJECT

To go through the specific projects starting on page 275, the first item is the power reactor development acceleration project in the amount of $11.5 million. This is an item we are requesting which is a general item which we feel we have a need for. Last year we had a power-acceleration item of this nature in the amount of $15 million. It is for the construction of special facilities, the need for which arises during the year due to the fact that we are accelerating the power-reactor program. It may be for reactor experiments themselves. It may be for buildings associated therewith, or for hot cells, and facilities of this nature in support of the Government program.

Mr. BOLAND. Specifically, by item, what sort of plan do you have?

Mr. FIELDS. Mr. Davis is Director of the Division and will answer.

Mr. BOLAND. Why don't you insert a tabulation in the record showing a basis for the estimate and that will suffice?

Mr. FIELDS. Yes, sir.

(The information follows:)

BASIS FOR THE ESTIMATE FOR THE POWER REACTOR DEVELOPMENT ACCELERATION PROJECT

Completely firm plans are not available but the most likely projects and approximate amounts are as follows:

Plutonium Fabrication Laboratory, Hanford, Wash	$4,000,000
Hot cells and waste storage system, Santa Susana, Calif	2,200,000
Power reactor test building and hot cells, Los Alamos, N. Mex	2,600,000
Zero power reactor (ZPR–6), Argonne National Laboratory, Illinois	2,700,000
Total	11,500,000

58–E–2 PUERTO RICAN POWER REACTOR

Mr. FIELDS. The next item is the Puerto Rican power reactor. This was for the construction of a power reactor in Puerto Rico at a power level of fifteen to twenty-five thousand kilowatts. It was not included in the authorization bill.

58–E–3 FUELS TECHNOLOGY CENTER

The next item, the fuels technology center at Argonne National Laboratory in the amount of $10 million is for the provision of a new center for the handling of plutonium which is necessary to develop in the power program.

58–E–4 MODIFICATIONS AND ADDITIONS TO ANP GROUND TEST PLANT

The next item is a modification and addition to the aircraft propulsion ground test plant at Idaho. This is a requirement for the provision of facilities so the testing program can go along.

58–E–5 TEST INSTALLATIONS FOR CLASSIFIED PROJECT

The next item, test installations for classified project, the total authorized amount is $9 million, and we are requesting $2.5 million for obligations in 1958.

(Discussion off the record.)

58–E–6 PROJECT SHERWOOD

Mr. FIELDS. The next item, Project Sherwood plant, $7,750,000, we are asking for obligation of $5 million in fiscal 1958. This is for the provision of facilities in support of the controlled thermonuclear program. It would provide for facilities at a number of different locations—Princeton, Livermore, Calif.; Los Alamos, N. Mex.—in varying amounts and these are covered in the explanation included herein.

58–E–7 WASTE CALCINATION SYSTEM

The next item, a waste calcination system at the National Reactor Testing Station in the amount of $4 million is a project for the construction adjacent to the waste storage area and will comprise several shielded hot cells containing calcination equipment used to reduce the wastes from the chemical processing plants so they may be properly stored and safeguarded.

58–E–8 HOT CELLS

The next item in the amount of $3.5 million is for the provision of hot cells. These are cells in which there is shielding and provision for handling behind shielded walls the materials that are needed to be studied that have been irradiated and do in themselves give forth radiation. They bisect the reactor fuels and other materials and study them. We have great need for additional hot cells in our reactor program.

58–E–9 HIGH-TEMPERATURE TEST INSTALLATION

The next item is a high-temperature test installation at the Bettis plant in Pennsylvania. It is a requirement in support of the naval program in the conduct of a high temperature critical experimental facility to study the performance of pressurized water reactors for naval use.

58–E–10 DESTROYER REACTOR DEVELOPMENT PLANT

The next item, a destroyer reactor development plant at Knolls Atomic Power Laboratory in the amount of $750,000 is to provide the building and housing that will be required for the construction of a destroyer prototype reactor critical assembly which is included in the operating appropriation request. This is for the provision of the permanent part of the facilities and for the critical experiment associated with that.

58–E–11 SODIUM REACTOR EXPERIMENT MODIFICATIONS

The next item, the sodium reactor experiment modification at Santa Susana, Calif., is estimated at $4,700,000. We are asking for obligational authority of $500,000 in fiscal 1958. This amount will permit the design, but the total of $4,700,000 is for modification of that reactor for the installation of a subsequent core to improve its performance. I should not say improve it, but it is a part of the development program for getting the most out of that experiment that we can. We will have a different moderator configuration that will be utilized, with a different specification on the fuel.

58–E–12 LIQUID METAL FUEL REACTOR EXPERIMENT

The liquid metal fuel reactor experiment in the amount of $17,500,000 is for the construction of a reactor experiment in a new concept that has been under study at Brookhaven National Laboratory and a contract also with Babcock and Wilcox associated with the Brookhaven National Laboratory. It is a new reactor type that we believe should be constructed in fiscal 1958.

Mr. JENSEN. This sodium reactor is the same type of reactor as you are now experimenting with for the proposed Nebraska plant, is it not?

Mr. FIELDS. That is true. This is still a different type of liquid metal as I understand it.

Dr. DAVIS. This liquid metal fuel reactor is a reactor which operates with bismuth as the coolant and has a very small amount of uranium dissolved in the bismuth. It does not use sodium as the coolant.

Mr. JENSEN. You call it a sodium reactor.

Dr. DAVIS. I am sorry. I was thinking of the liquid metal reactor fuel experiment.

Mr. FIELDS. I was, too. The sodium reactor experiment, the item of $4,700,000 is for the installation of an improved core following the development work associated with that sodium reactor experiment that is going on there at Santa Susana. This is a step toward the sodium graphite large-scale powerplant that would be built in Nebraska.

Dr. DAVIS. The large scale powerplant that was proposed to be built in Nebraska actually will be patterned after the present core in the sodium reactor experiment and that is one of the reasons that the delay so far has not been serious because we are just now starting to operate that first core. The Consumers plant would be based on this design as it is now tested out. However, it is our plan to take the core completely out of the sodium reactor experiment and to put into it, in another year and a half or 2 years' time, a completely new core with a different configuration of the graphite moderator, possibly a different method of canning the graphite itself, probably a somewhat different control system and surely a considerably different system of fuel elements. So it will then be quite a different reactor experiment and one we hope which would be quite a bit advanced. But it would not be in time to be of any particular value as a prototype for the Consumers reactor.

Mr. JENSEN. Then I presume you will hold up the construction of the plant such as you propose in Nebraska until this experiment has been proven?

Dr. DAVIS. No. We would not plan to. This would be an advanced experiment. It is planned that the Consumers plant would be based on the operation which is now getting started.

Mr. STRAUSS. I think I can explain this, Mr. Jensen. When the sodium reactor experiment at Santa Susana has proved itself, as indeed it has, the prototype of the plant in Nebraska, instead of building a brand new prototype for the advance design of a liquid metal cooled reactor, we are going to dismantle the one at Santa Susana and improve it according to these specifications which Dr. Davis has just outlined and in effect it will be a totally different kind of reactor. It is simply a method of using that site and that generating capacity, building and all, to build a new reactor inside of the shell.

58-E-13 ARGONNE BOILING REACTOR

Mr. FIELDS. I had covered the liquid metal fuel reactor experiment. The next one would be the Argonne boiling reactor, in the

amount of $8.5 million for obligational authority. This is for the construction of a very flexible boiling water reactor experiment at the Arco National Reactor Testing Station in Idaho. There has been great success with this boiling-reactor concept. We believe with this kind of experimental reactor varying types of operations can be tried with it, and will add materially to the improvement of those reactors which show such great promise.

58–F–1 WASTE STORAGE TANKS

The next item is a waste storage tank at the National Reactor Testing Station in the amount of $3.7 million. This is a requirement for the construction of additional storage tanks to take care of the liquid wastes that are associated with the chemical processing plants that we operate there.

58–F–2 HOT PILOT PLANT

The next item is $2 million for a hot pilot plant.

Dr. DAVIS. This is a project for pilot plant work on various types of chemical processing, the so-called head-end treatment which is concerned with the taking of different kinds of fuel elements and dissolving them into a form where they can be put as a solution into the chemical processing plant.

58–F–3 LAND ACQUISITION AT IDAHO

Mr. FIELDS. The next item is for land acquisition at the National Reactor Testing Station in the amount of $1 million. Here the project contemplates the acquisition of approximately 150,000 acres of additional land. A large part of this is Government land. Acquisition is necessary in order to assure a protective area to permit the operation of facilities there. We are getting a great many different types of reactors that are in operation at that site.

GENERAL PLANT PROJECT

The next item is a general plant project in the amount of $5 million. Here again it has the same purpose as previous general plant items for other programs. It is for support of facilities operated under the reactor development program.

Mr. BOLAND. What were the levels of expenditures in 1956?

Mr. MCCARTHY. The obligations were $2,290,000 in 1956, and in 1957 the amount involved was $2,915,000.

Mr. FIELDS. May I remark that in conjunction with this there has been a considerable expansion in plant in the reactor program since 1956, namely, in the facilities at Idaho which have grown very markedly in this period, as well as certain of the facilities at the Knolls Atomic Power Laboratory and elsewhere. So I believe an increase is warranted in this program.

58–111 COOPERATIVE POWER ARRANGEMENTS

The cooperative power arrangements is the next item in the amount of $44,275,000, of which we are asking for obligational authority $38,296,000.

Mr. McCarthy. I wanted to point out that this money is in hand against the construction of these reactors under the cooperative arrangement. It is shown here because of the new authorization in section 111 of the new authorization bill.

Mr. Fields. This is for the plant part of the cooperative arrangements that we would support. There are five reactors that are involved in this.

57–C–3 MODIFICATIONS AND EXPANSIONS OF ANP GROUND TEST FACILITIES

The next item, modifications and expansions of the aircraft nuclear propulsion ground test facilities, area No. 1, Idaho, is a 1957 item, for which $5 million is required in 1958.

56–B–6 ANP PROGRAM PLANT AND TEST AREA

The next one just below that similarly for the program plant test area at Arco, Idaho, is a 1956 item. This has been funded through 1957 in the amount of $10 million. We are asking for obligations in 1958 of $3 million to complete it. Those are for the facilities at Arco.

TRANSFER OF FUNDS

Mr. Jensen. I have a question which relates to items such as this where the amount of money that you request is a safe amount that you anticipate you may need. My question is this: Couldn't we save money by giving AEC permission to transfer funds from one branch of your agency to another or one project to another in the amount of 10 percent? Some of these items are large. We give other agencies of Government the privilege of transferring funds up to as much as 50 percent. Here you have some items that you requested funds for a number of years ago and you have not yet found it necessary to use those funds. Having the privilege of transferring, say, 10 percent of your funds from one project to another or from one branch of your agency to another, you would then find it not necessary to ask for funds over and above that amount which you feel very sure you might need.

I can undertsand why you want to be safe in the amount of money you request because this is an important business, and it affects the security of America, and you don't want to take any chances of not having enough money to spend for all these different things for which you are responsible. So I am wondering what your reaction would be, Admiral Strauss and Mr. Fields, or anybody else who wants to answer it, as to giving you permission to transfer up to 10 percent.

Mr. Strauss. Mr. Jensen, it would be a flexibility that would assist us materially if we could get it.

Mr. Jensen. You say it would?

Mr. Strauss. It would indeed, from my point of view.

Mr. Jensen. Could we reduce the level of the amount of new funds requested, or could you be safe in having that done this year?

Mr. STRAUSS. It is impossible to relate it to the funds requested this year because these have been screened down to the minimum that we see. But considered as an abstract proposal, I can see that in subsequent years if we had flexibility to the extent of 10 percent of appropriations, it might result in some savings. It would certainly mean an easier way for us to operate. We could take advantage of some opportunities for economies and efficiencies during a year which otherwise we have to wait for an appropriation and things have gotten out of hand, such as supplies going up, labor going up.

Mr. JENSEN. Congress has for many, many years past permitted each agency of Government or most every agency of Government to transfer up to 10 or 15 percent. Had we not been very sure that privilege has saved us money we would have stopped it.

Mr. STRAUSS. The General Manager says that to a degree we have such a privilege.

Mr. JENSEN. I know you have, but it is not a general permission.

Mr. FIELDS. There is control upon the individual projects themselves in the sense that there is an allowance for 25 percent overrun in certain cases or 10 percent in others.

Mr. JENSEN. I know that.

Mr. FIELDS. The appropriation is a total appropriation so within that we may apply those percentages. It may mean we have to curtail something if one of the projects turned out to be more expensive than we estimate. In that sense we do not have complete flexibility.

Mr. JENSEN. No, that is right. I see no reason why the Atomic Energy Commission should not have that privilege and I see no reason why it could not save money in the long run.

Mr. FIELDS. The reason we have 2 items that Mr. Boland asked me about specifically is that the contingency items, 1 in the weapons program and 1 in the reactor program, is because we do need flexibility to a degree in some of these programs for new requirements that come up that cannot be anticipated in the budget cycle sufficiently in advance to get authorization. That is why we do have this $11.5 million project for power-reactor acceleration and a $10 million item in the weapons program. We should be able to build things that arise in the fiscal year. It would be very helpful.

Mr. JENSEN. I can see a number of places after listening to your testimony today and other days where you have attempted to be completely sure that you have enough money to carry on these important functions. If you had the authority to transfer from one branch of your Commission to another in the amount of 10 percent, you would then have a feeling of security in the knowledge that, should one branch of your service not need as much as you had anticipated a year ahead of time, you could take up to 10 percent of that item and transfer it to an item where you would like to spend more money and in the long run make a saving. I realize that is putting greater responsibility on you and at the same time we are putting more confidence in you. I am willing and ready to do that because I am sure that you don't want to spend any money that is not necessary to spend. So I hope you think it over and see if it would not be good for you folks and for the taxpayers of America and for the program that you are responsible for.

That is all, Mr. Chairman.

Mr. BOLAND. In line with that, Mr. Fields, there is $296,648,000 presently available from prior-year appropriations that you mention in your summary statement, which would indicate that apparently you are moving a little bit slowly. I am just wondering what the status of plans and specifications in the projects for which you are now seeking money for 1958. You can tabulate the percentages on these projects.

Mr. FIELDS. Yes, we can do that. We do estimate that we will be in a position to obligate $193 million in this fiscal year.

(The information requested follows:)

Status of fiscal year 1958 construction projects

Project No.	Title	Percent completion, plans and specifications	Estimated date construction and/or major procurement starts	Estimated completion date
	SPECIAL NUCLEAR MATERIALS PROGRAM			
58-b-1	Fabrication Plant	0	January 1958	July 1959.
58-b-2	Mechanical Production Line, Hanford, Wash.	(1)	September 1957	August 1959.
58-b-3	Metal Treatment Plant, Fernald, Ohio	0	January 1958	February 1959.
58-b-4	Improvements to Production and Supporting Installations, Hanford, Wash., and Savannah River, S. C.	(2)	(2)	(2).
58-b-5	Additions to Scrap Plants, Various Sites	0	November 1957	January 1959.
58-b-6	Additions to Gaseous Diffusion Plants	0	October 1957	June 1959.
58-b-7	Reduction of Fire Hazards—Gaseous Diffusion Plants, Oak Ridge, Tenn.; Paducah, Ky.; and Portsmouth, Ohio.	0	January 1958	July 1960.
	WEAPONS PROGRAM			
58-c-1	Weapons Production and Development Plant.	(2)	(2)	(2).
58-c-2	Weapons Special Component Plant	0	January 1958	March 1959.
58-d-1	Manufacturing Plant Expansion, Albuquerque, N. Mex.	0	November 1957	October 1958.
58-d-2	Storage Site Modifications	(2)	(2)	(2).
58-d-3	High Explosive Development Plant, Livermore, Calif.	0	November 1957	May 1959.
58-d-4	Engineering and Laboratory Building, Los Alamos, N. Mex.	18	December 1957	January 1959.
58-d-5	Ventilation System Replacements, Los Alamos, N. Mex.	0	September 1957	October 1958.
58-d-6	Reclamation Foundry, Shop and Warehouse, Sandia Base, N. Mex.	0	December 1957	June 1958.
58-d-7	Reactor, Area III, Sandia Base, N. Mex.	0	do	February 1959.
58-d-8	Base Construction, Nevada Test Site	0	September 1957	September 1958.
58-d-9	Base Construction, Eniwetok Proving Ground.	85	do	March 1959.
	REACTOR DEVELOPMENT PROGRAM			
58-e-1	Power Reactor Development Acceleration Project (following subprojects based on present planning):			
	Hot Cells and Waste Storage, Santa Susana, Calif.	0	February 1958	November 1958.
	Plutonium Fabrication Laboratory, Hanford, Wash.	4 100	September 1957	April 1960.
	Power Reactor Test Building and Hot Cell, Los Alamos Scientific Laboratory, N. Mex.	4 10	do	January 1959.
	Zero Power Reactor (ZPR)-6, Argonne National Laboratory, Ill.	0	October 1957	October 1958.
58-e-2	Puerto Rico Power Reactor	0	March 1958	December 1959.
58-e-3	Fuels Technology Center, Argonne National Laboratory, Ill.	0	February 1958	June 1960.

See footnotes at end of table, p. 275.

Status of fiscal year 1958 construction projects—Continued

Project No.	Title	Percent completion, plans and specifications	Estimated date construction and/or major procurement starts	Estimated completion date
	REACTOR DEVELOPMENT PROGRAM—con.			
58-e-4	Modifications and Additions, Aircraft Nuclear Propulsion Ground Test Plant, Area No. 1, National Reactor Testing Station, Idaho.	0	January 1958	October 1959.
58-e-5	Test Installations for Classified Project	5	November 1957	November 1959.
58-e-6	Project Sherwood Plant	4	October 1957	September 1959.
58-e-7	Waste Calcination System, National Reactor Testing Station, Idaho.	[4] 35	March 1958	October 1959.
58-e-8	Hot Cells	[3]	[3]	[3]
58-e-9	High Temperature Test Installation, Bettis.	[4] 15	September 1957	January 1959.
58-e-10	Destroyer Reactor Development Plant, KAPL.	0	November 1957	December 1958.
58-e-11	Sodium Reactor Experiment (SRE) Modifications.	[5]	July 1958	September 1959.
58-e-12	Liquid Metal Fuel Reactor Experiment	0	February 1958	October 1960.
58-e-13	Argonne Boiling Reactor (ARBOR), NRTS.	[4] 30	September 1957	September 1960.
58-f-1	Waste Storage Tanks, National Reactor Testing Station, Idaho.	[4] 92	November 1957	March 1959.
58-f-2	Hot Pilot Plant	0	March 1958	June 1959.
58-f-3	Land Acquisition, National Reactor Testing Station, Idaho.	0	October 1957	June 1958.
58-111	Cooperative Power Arrangements Project	[6]	[6]	[6].
57-c-3	Modifications and Expansions of ANP Ground Test Facilities, Area No. 1.	[7] 84	December 1957 [7]	July 1959.[7]
56-b-6	ANP Program Plant and Test Area, Arco, Idaho.	[7] 0	do	May 1960.[7]
	PHYSICAL RESEARCH PROGRAM			
58-g-1	Accelerator Improvements, University of California Radiation Laboratory.	0	October 1957	September 1958.
58-h-1	Reactor Improvements, Argonne National Laboratory, Ill.	[4] 100	December 1957	May 1958.
57-d-1	High Energy Accelerator, Argonne National Laboratory (as amended by 1958 authorization).	[5]	July 1958	Fiscal year 1963.
57-h-5	Cosmotron Target Area, Brookhaven National Laboratory (as amended by 1958 authorization).	0	February 1958	October 1959.
	BIOLOGY AND MEDICINE PROGRAM			
58-i-1	Mammalian Radiation Injury and Recovery Area, Oak Ridge National Laboratory.	0	January 1958	September 1958.
	TRAINING, EDUCATION AND INFORMATION PROGRAM			
58-j-1	Nuclear Training Project, Regional Nuclear Training Center, Puerto Rico.	0	do	June 1959.
	COMMUNITY PROGRAM			
58-k-1	Schools, Los Alamos, N. Mex.	0	November 1957	September 1958.
58-k-2	Housing Modifications, Los Alamos, N. Mex.	0	September 1957	December 1958.

[1] Preliminary design 100 percent complete, detailed specifications and drawings 8 percent complete.
[2] This project is comprised of a series of subprojects for which various construction starting dates are expected to take place within fiscal year 1958.
[3] This project will be undertaken at various locations with starts at various times throughout fiscal year 1958.
[4] Applicable to preliminary design.
[5] The amount included in the fiscal year 1958 estimate provides for start of detailed design.
[6] It is estimated that all contracts as yet unsigned for cooperative arrangements under the first and second round invitations will be signed in fiscal year 1958. Actual starting dates will depend on date of contract signing.
[7] Applicable to portion of project being funded in fiscal year 1958.

Mr. JENSEN. That still leaves how much?

Mr. FIELDS. That is $103 million in unobligated balances.

Mr. JENSEN. Along that line, if you had the authority to transfer as I have just spoken of, then it would not be necessary for you to request this additional $103 million; is that not right?

Mr. FIELDS. That is true, except that there is a requirement in section 261 of the Atomic Energy Act of 1954 for authorization of appropriations for plant projects. This is a requirement in itself that requires previous authorization for plant items.

Mr. JENSEN. But you don't have authority to transfer this $103 million to some other part of your Commission activity.

Mr. FIELDS. That is correct. We can apply it within the percentage increases that are permitted on these individual authorizations, maybe 10 or 25 percent, but it will never be that total.

Mr. MCCARTHY. I think I should point out that of the $103 million unobligated at the end of 1957, there is $64 million that is free for the new fiscal year. That is the free balance to apply to a new appropriation, Mr. Jensen.

PHYSICAL RESEARCH PROGRAM—CONSTRUCTION OBLIGATIONS

Mr. BOLAND. We will move on to the physical research program. We will insert pages 295 through 301 of the justification.

(The information follows:)

PHYSICAL RESEARCH PROGRAM, CONSTRUCTION OBLIGATIONS

Program statement

Estimated obligations, fiscal year 1958	$17,566,000
A. Obligations for new projects	(7,605,000)
B. Obligations for prior year projects	(9,961,000)
Estimated obligations, fiscal year 1957	23,048,000
Actual obligations, fiscal year 1956	5,997,214

Obligations for the physical research program for fiscal year 1958 are estimated at $17,566,000, of which $7,605,000 is for new projects justified in section A below which were authorized in the fiscal year 1958 authorization act or were previously authorized and for which a request for appropriation was deferred until fiscal year 1958. The balance of $9,961,000 is for projects listed under section B below which were authorized prior to fiscal year 1958 and for which funds have previously been appropriated but are now carried over into fiscal year 1958.

SECTION A

The projects comprising section A are as follow:

Project No.		Total estimated cost	Obligations incurred through fiscal year 1957	Estimated obligations, fiscal year 1958	Funding required after fiscal year 1958 to complete project
58-g-1	Accelerator improvements, University of California Radiation Laboratory, California.	$875,000	0	$875,000	0
58-h-1	Reactor improvements, Argonne National Laboratory, Illinois.	380,000	0	380,000	0
58-1	General plant projects	1,300,000	0	1,300,000	0
57-d-1	High energy accelerator, Argonne National Laboratory (as amended by 1958 authorization).	27,000,000	0	1,500,000	$25,500,000
57-h-5	Cosmotron target area, Brookhaven National Laboratory (as amended by 1958 authorization).	3,550,000	0	3,550,000	0
	Total	33,105,000	0	7,605,000	25,500,000

Explanation of projects in section A

1. *Project 58–g–1 Accelerator improvements, University of California Radiation Laboratory, $875,000.*—This project provides for improvements to the existing accelerators at the University of California Radiation Laboratory. It includes improvements to the Bevatron, the 184-inch cyclotron and the heavy ion accelerator and to the research equipment and other installations that are required and utilized in conducting experiments with these machines. Included are such items as research magnets, shielding, research caves, scattering chambers, counting capabilities, and additional mechanical and electrical utilities.

The additions and improvements to the Berkeley accelerators and to the research installations used in conjunction with the accelerators are required in order to increase the versatility, effectiveness, and utility of these machines as research tools. The expanded physical research program at Berkeley contemplates an increase in the variety and number of experiments using the accelerators and, accordingly, improved accelerator utilization, efficiency, and versatility must be obtained. These improvements will provide for increasing the use of the accelerators and for increasing the scope of experiments that can be conducted with the machines, and will add to the potentiality of developing new data in the physical research program.

2. *Project 58–h–1 Reactor improvements, Argonne National Laboratory, $380,000.*—This project provides for improvements to the CP–5 reactor at the Argonne National Laboratory in order to increase its power level. These improvements include: (1) additional cooling capacity, (2) a service facility for hot storage and maintenance, (3) the improvement of the top shielding of the reactor, and (4) additional fuel cutting and handling equipment.

The reactor has been operating at a maximum level of 1 megawatt since it came into operation. The power level will be increased to 2 megawatts in fiscal year 1957, and to 4 megawatts when the proposed improvements are completed. The higher power level will increase considerably the usefulness of the reactor for experimental work and will result in a reduction in the cost of service irradiations.

3. *Project 58–1 General plant projects, $1,300,000.*—This project provides for the minor and often individually unpredictable capital improvements, modifications and additions that are required each year to conduct the research and development program at the Oak Ridge National Laboratory, the Ames Laboratory and in the off-site physical research program. The funds requested for fiscal year 1958 will be used as follows:

Oak Ridge National Laboratory	$1,000,000
Ames Laboratory	50,000
Off-site research program	250,000
Total	1,300,000

4. *Project 57–d–1 High energy accelerator, Argonne National Laboratory (as amended by 1958 authorization), $1,500,000.*—This project provides for the design and construction of a high-intensity, high energy proton accelerator (approximately 12.5 billion electron volts) and related laboratory and experimental areas at the Argonne National Laboratory. This project was authorized in fiscal year 1957 (project 542–57–d–1) for $15 million. The justification was made on the basis of an urgent need for extending the energy range beyond that of presently available machines. The site and specifications for the machine were undetermined at the time of its authorization.

Subsequent to the authorization of this project, the Argonne National Laboratory was selected as the site for this machine and a study was conducted to determine whether an accelerator meeting the present requirements could be built for $15 million. It was found that any accelerator built for this amount would exceed neither the energy nor the intensity of an existing machine or one already under construction in the United States. As a consequence, it was necessary to supplement the authorization for this project to reflect an increase in the estimated cost from $15 million to $27 million. The request of $1,500,000 for fiscal year 1958 will enable the Commission to begin the detailed design of the accelerator.

This project will provide an accelerator much needed in the United States at an energy and intensity not otherwise available. The proposed machine will provide a copious source of antiprotons and antineutrons and will thus open the whole field of "antimatter" reactions for precise experimentation. The bevatron

has permitted the discovery of these particles but its energy of 6 bev is too low for their production on a scale for precise experimentation. The machine will be capable of producing 10^{13} protons per minute, which is greater by a factor of 1,000 than that expected to be produced by the alternating gradient synchrotron now under construction at the Brookhaven National Laboratory. Its yield of antiprotons will be hundreds of times more than that of the bevatron.

5. *Project 57–h–5 Cosmotron target area, Brookhaven National Laboratory, as amended by 1958 authorization, $3,550,000.*—This project provides for the design and construction of improvements and modifications to the cosmotron located at Brookhaven National Laboratory. It includes modifications to the cosmotron machine, improvements and expansion to the experimental areas around the machine, and additional shielding for the machine and experimental areas.

The cosmotron research program is seriously limited in terms of its scope and effectiveness because of the need for a number of improvements and modifications to the machine and for an expansion of the experimental areas. An amount of $350,000 was authorized in fiscal year 1957 for the construction of a cosmotron target area. The project was thought to be adequate by 1955 standards. However, subsequent to the authorization of that project, the intensity of the cosmotron beam (originally expected to be 10^{10} protons per pulse) has been increased to 10^{11} protons per pulse. There has also been an increase in the operating time of the cosmotron. The resulting radiation hazard for the workers around the machine has become increasingly serious, and additional shielding is needed to assure that radiation exposure does not exceed tolerance levels. Also, in view of increased and varied demands for operating time on the machine, modifications and expansion of the facilities are required to increase the effectiveness of the machine for research. It was therefore necessary to supplement the authorization for this project to reflect an increase in the estimated cost from $350,000 to $3,550,000, to provide for the improvements and expansion required to reduce the radiation exposure level and to enable the laboratory to increase the number of experiments that can be simultaneously conducted with the cosmotron.

SECTION B

The projects comprising section B which have been previously authorized and for which funds have previously been appropriated but are now carried over into fiscal year 1958 are:

Project No.	Title	Total estimated cost	Obligations incurred through fiscal year 1957	Obligations to be incurred in fiscal year 1958
57–d–4	Conversion of accelerator design buildings, University of California Radiation Laboratory.	$300,000	0	$300,000
57–h–6	18-inch cyclotron building, Brookhaven National Laboratory.	300,000	$14,000	286,000
56–c–1	Particle acceleration program	12,300,000	8,925,000	3,375,000
5–62x–4019	Alternating gradient synchrotron	26,000,000	20,000,000	6,000,000
	Total	38,900,000	28,939,000	9,961,000

Mr. FIELDS. On page 296, new obligational authority in the amount of $7,605,000 is requested for fiscal 1958, against a total authorization in the bill that was just for this program, passed in the amount of $33,105,000. The large difference is in the item on the high energy accelerator, item 57 (b) (1). The total estimated cost is $27 million but we are requesting only obligational authority in the amount of $1,500,000 in 1957 for the performance of engineering and design studies with relation to that particular project.

58–G–1 ACCELERATOR IMPROVEMENTS

The first item in the amount of $875,000 is for improvement in accelerators at the University of California Radiation Laboratory.

58–H–1 REACTOR IMPROVEMENTS

The second item, $380,000, is for improvements at the CP–5 reactor at Argonne Laboratory. General plant project, here again is the general plant item of $1,300,000 for the support of facilities under the purview of the Research Division.

57–H–5 COSMOTRON TARGET AREA

The last item, the cosmotron target area, is for enlargement to that area for safety reasons as well as for versatility and performance of the machine. This gives you the total obligation authority for 1958 requested for this program of $7.6 million.

Biology and Medicine—Construction Obligations

Mr. Boland. We will insert pages 302 to 304 on the Biology and Medicine Division program.

(The information follows:)

BIOLOGY AND MEDICINE PROGRAM, CONSTRUCTION OBLIGATIONS

Program statement

Estimated obligations, fiscal year 1958	$1,822,000
A. Obligations for new projects	1,441,000
B. Obligations for prior year projects	381,000
Estimated obligations, fiscal year 1957	1,405,000
Actual obligations, fiscal year 1956	6,205,062

Obligations for the biology and medicine program for fiscal year 1958 are estimated at $1,822,000 of which $1,441,000 is for new projects justified in section A below which were authorized in the fiscal year 1958 authorization act. The balance of $381,000 is for the project listed under section B below which was authorized prior to fiscal year 1958 and for which funds have previously been appropriated but are now carried over into fiscal year 1958.

SECTION A

The projects comprising section A are as follows:

Project No.	Title	Total estimated cost	Obligations incurred through fiscal year 1957	Estimated obligations, fiscal year 1958	Funding required after fiscal year 1958 to complete project
58–1–1	Mammalian radiation injury and recovery area.	$475,000	0	$475,000	0
58–1	General plant projects	966,000	0	966,000	0
	Total	1,441,000	0	1,441,000	0

EXPLANATION OF PROJECTS IN SECTION A

1. *Project 58–1–1 Mammalian radiation injury and recovery area, Oak Ridge National Laboratory, Oak Ridge, Tenn., $475,000.*—This project provides for an additional biological area to be housed in presently unused space in the Oak Ridge National Laboratory Research Building 9207, Y–12 plant. This area is required to maintain large numbers of experimental animals for the purpose of obtaining data on their reactions to radiation injury, and their

recovery as a result of various methods of chemical and cell-infusion treatment.

Important advances made in the past year make it highly desirable to expand the research program in radiation injury, protection and recovery. Recent experiments have shown the need for continuing protection, recovery, and immunological studies in irradiated animals over long periods of time after they are irradiated. These promising preliminary research efforts, originally conceived and carried out in all experiments as short-term projects, indicate that long-term experiments which require large scale animal maintenance are warranted. In addition, equally important and related work on the delayed effects of irradiation, such as shortening of life span and the induction of cataracts, leukemia, other neoplasma and premature aging, is being amplified and expanded.

Existing laboratory space is not adequate for the expanded program now considered necessary. Alteration of the space available in building 9207 will provide the additional area required. The expanded program will occupy a net working area of 19,000 square feet and include 21 animal rooms, 13 associated treatment and observations rooms, and 10 small rooms for cage cleaning, feed storage, utility equipment and general service. The work will consist of installation of partitions, hung ceilings, electrical and other services, and temperature and humidity control for the protection of experimental animals.

2. *Project 58–1. General plant projects, $966,000.*—This project provides for miscellaneuos alterations, and additions, improvements, and minor construction at various installations under the direction of the Division of Biology and Medicine. These include the Brookhaven National Laboratory, the Atomic Bomb Casualty Commission in Japan, the Oak Ridge Institute of Nuclear Studies, the Argonne Cancer Research Hospital, and atomic energy projects at the University of Rochester, the University of Tennessee, Sylvania Electric Products, Inc., and New York University, the Health and Safety Laboratory in New York, and off-site research projects at colleges, universities, and other research institutions throughout the country. The estimate is based on past experience at the several locations with consideration given to the size of the facility, the type of work performed, and programatic changes contemplated. It includes improvements and modifications to major research tools such as the Brookhaven reactor and cosmotron; minor additions, alterations, and construction at the various installations listed above to improve operating efficiency, reduce health and safety hazards, and to protect the Commission's investment in plant; and minor construction at off-site laboratories to assist in special research studies.

SECTION B

The project comprising section B which has been previously authorized and for which funds have previously been appropriated but are now carried over into fiscal years 1958 is:

Project No.	Title	Total estimated cost	Obligations incurred through fiscal year 1957	Obligations to be incurred in fiscal year 1958
57–I–1	Reclamation plant and hot laundry, Brookhaven National Laboratory.	$400,000	$19,000	$381,000

58–I–1 MAMMALIAN RADIATION INJURY AND RECOVERY AREA

Mr. FIELDS. The first is the radiation injury and recovery area in the amount of $475,000. This is for expansion of the area for the performance of studies on animals. This work is located at Oak Ridge.

58–L GENERAL PLANT

The second item, for general plant projects in the amount of $966,000, is for the support of projects under the division of biology and medicine program at various places like Brookhaven National Laboratory, Oak Ridge Institute and the cancer hospitals that they operate.

Mr. BOLAND. Are there any questions?

Mr. JENSEN. Dr. Dunham, would you like to say anything about this request for funds and make a short statement on the progress you have made? This field of medicine during the past year?

PROGRESS ON RADIATION RECOVERY PROGRAM

Dr. DUNHAM. I think in this area of radiation recovery—is this what you had specific reference to—there has been considerable progress made both from the standpoint of using chemicals to pretreat an animal before radiation injury and using bone marrow transplants after radiation injury. The need for this particular project is simply that up until now most of the experiments in this field have lasted about 1 month to see whether the animal lived or died during that period. The bone marrow experiments take at least 100 days and in order to find out what effect either pretreatment or bone marrow has on the delayed or long-term effect of radiation injury such as shortening of life span, development of leukemia and that sort of thing, it becomes necessary to keep the animals throughout the rest of their natural lives. This means a real need for an enlarged animal facility. It is simply to hold these animals, and particularly if one carries on for another generation to see what, if any, sparing effects these treatments have on the genetic injury.

Mr. JENSEN. And you can liken those experiments to experiments on humans to a very great degree, can you not?

Dr. DUNHAM. It is much the same; yes, sir.

Mr. JENSEN. What are the different animals that are used in this experiment?

Dr. DUNHAM. Usually the studies are started with mice, because they are simple and cheap to work with. Then one tries to verify this sort of thing in rats, which are a little larger and longer lived, and then you go to something like dogs and monkeys which live anywhere from 10 or 12 to 20 or 25 years. Sometimes rabbits are used; sometimes guinea pigs. It depends a little on actually what one is studying, because in some respects one animal, as far as a given organ system is concerned, is more like a human than another. The immune mechanisms of a mouse are quite similar to those of a human, whereas those in a dog are quite different.

Mr. JENSEN. If you would like to elaborate on the statement you make after you get the transcript, I would like to have you do so, because this is an experiment that a lot of people are interested in.

Dr. DUNHAM. That is right.

Mr. JENSEN. They would like very much to know just what can be expected in this experiment. There has been a lot written about it in the newspapers and magazines by some folks who think they are experts, and there are too many people who take them as experts. I think a word from you, Dr. Dunham, would quiet some of their misgivings and some of their fears. In some instances it might even cause them to have a few more fears, but I think, generally speaking, it would quiet their feelings and apprehensions as to just what was going to happen to them if the day ever comes, and I hope it never comes, when we will be subjected to an enemy bomb. We have enough anxiety over a bomb that is dropped for experimental purposes. Will you please elaborate on that?

Dr. DUNHAM. I will do that.

Mr. JENSEN. You may have to differ with some of these experts. I would like to see what you have to say about it, and I think millions of other people would like to read what Dr. Dunham, of the Atomic Energy Commission, has to say about it. That is all.

(The following information was subsequently furnished to the committee:)

PROPHYLACTIC ANTIRADIATION COMPOUNDS

S,β-Aminoethylisothiuronium Br·HBr (AET) is one of a series of related compounds that we have shown to be effective, reducing the apparent lethal radiation dose to the animal by a factor between 2 and 3, when administered prior to irradiation. These compounds are completely ineffective when given after radiation. An AET-treated animal receiving 900 roentgens (a dose lethal to 100 percent of the untreated animals within 12 days) will survive and be comparable to an untreated one receiving 400 roentgens in many aspects, such as recovery of the bone marrow, body weight, and blood system in general. It will live out 75 percent or better of its normal life span, and in many aspects it seems normal. It cannot be stressed too strongly that the animal is not completely protected against radiation damage, publicity to the contrary. Although the animals appear normal in many respects, they do show some signs of radiation damage, such as gray fur, a greater incidence of cataract formation, and shortened life span. The genetic effects in such survivors have not yet been examined.

Of paramount importance is the toxicity of these compounds and the relation between their therapeutic or useful dose and the toxic dose. AET is the compound that has been most promising and extensively investigated. When injected intraperitoneally at a dose of 150 milligrams per kilogram of body weight, AET will protect the mouse against 900 roentgens—a lethal dose. The dose can be increased to a maximum of about 350–400 milligrams per kilogram of body weight with a corresponding increase in the protection observed. Thus, all the mice will survive 1,100–1,200 roentgens and half will survive 1,450–1,500 roentgens. When AET is administered orally, the results are somewhat better since 200 milligrams of AET per kilogram is effective at 900 roentgens; 560 milligrams of AET per kilogram of body weight provides the maximum protection since 675 milligrams per kilogram is the maximum dose of AET that can be given without poisoning the mice. Other related compounds, more active than AET, are presently being investigated.

AET may be administered orally up to 3 hours before radiation and all the animals will survive an otherwise lethal 900-roentgen dose. The conclusions arrived at with AET in mice are at present being restudied and confirmed in dogs and monkeys. Cautions preliminary human experiments indicate that, contrary to expectations from some of the animal data, AET may be somewhat more toxic to man.

The chemical protective agents, at this time, are excellent for the experimental study of radiation damage. It is now possible to examine the effects of large radiation doses since AET-protected animals may be given 1,500 roentgens and half will survive for many months. The chemical pretreatment may be combined after exposure with bone marrow and the radiation dose for half survival is then raised to 1,850–2,000 roentgens with a few animals surviving doses up to 2,600 roentgens. AET and related compounds, labeled with radioactive isotopes, are beginning to provide some insight into the cellular biochemical processes most sensitive to radiation damage.

A correlation between chemical structure and protective activity has been obtained from these experiments. This had permitted the formulation of a working hypothesis as to why these compounds are effective, as well as suggesting what the general chemical properties are that are required for good protective activity. This hypothesis is now being put to the test by the design, synthesis, and examination of new classes of compounds with the expectation of finding even more effective agents having more acceptable pharmacological properties. In addition, a continuing effort is being made to improve the pharmacological properties of the AET class of compounds.

BONE-MARROW TRANSPLANTATION

The possibility has recently developed that a more effective treatment can be worked out for persons exposed to doses of radiation in the 200- to 600-roentgen range.

When it was found that irradiated mice could be saved by the introduction of material from the spleen or bone marrow, it was first believed that simple extractives or perhaps pure chemical substances could be found that would modify the lethal course of the radiation syndrome. This idea has not been completely abandoned, but emphasis has shifted to transplantation of the progenitors of the cellular elements of the blood which will grow in the irradiated animal and tide him over the period when the functioning of his own bone marrow is depressed.

Severe depression amounting to failure of blood formation in the bone marrow is responsible for most of the deaths which occur in animals some 7 to 30 days after exposure. Ordinarily, tissues transplanted from one individual to another of the same but not inbred strain, and even more definitely to another individual of a different strain or species, are rejected and destroyed by the recipient. In the animal which has been given a lethal dose of radiation, however, this immune reaction is more or less lost, so that transplants of bone marrow become a novel possibility with practical applications in man. Experimental work has shown that the irradiated animal will accept bone-marrow transplants from different strains and species, but the transplant becomes increasingly less successful the greater the phylogenetic difference between the donor and the recipient. Thus, it is found that the irradiated mouse will accept marrow from all other mice, but the transplant of rat marrow is less certain, and dog or human marrow apparently fails to take permanently. Conversely, the greater the genetic similarity between the donor and the recipient, the lower the dose of radiation needed for a successful bone-marrow transplant. Prior to this discovery concerning the effects of radiation on transplants, it was the generally accepted belief that transplants in man are possible only between identical tissues.

These marrow transplants are not merely stopgaps, for it has been shown in a number of ways that the transplanted cells continue to live and function in the recipient. For example, some irradiated mice which have received rat bone marrow have recovered from the radiation syndrome and then continued to live out their life span, but with circulating blood cells which were all definitely those of the rat; in some instances the mouse's own marrow will recover sufficiently to suppress the rat cells completely; in others, the mouse will have circulating blood cells of both species.

Problems in methods of securing, handling, storing, and preserving marrow are largely technical, and their satisfactory solution can be anticipated with a fair degree of confidence. On the other hand, it is evident from these new findings that knowledge of immunology and the general field of tissue transplantation is deficient.

Knowledge concerning the immune relationship between lower animals is of definite value in establishing the patterns to be studied and explored in developing a practical clinical application of marrow transplanation. Idiotransplants are presently feasible; such a transplant involves the removal of some marrow from a person, temporarily storing it, and then reinfusing it into the same person. Development of the full scope of marrow transplants in man necessarily will be slow, because the science of human-tissue immunology must be further developed, and human material suitable for study is scarce.

The exciting new possibilities of marrow transplantation in man have already reestablished interest and research in this field. One result that can be expected is the development of therapeutic procedures which may be useful in several types of blood diseases. Other discoveries made as a result of current and future research in this field will be even more significant.

To this end, the Commission is suporting an estimated 90 percent of all the work going on in bone-marrow transplantation, and both on-site and off-site laboratories are actively engaged in experimental and clinical researches.

Training and Information—Construction Obligations

Mr. Boland. The next section is training and information section, and we will insert pages 305 and 306.

(The information follows:)

TRAINING, EDUCATION, AND INFORMATION PROGRAM, CONSTRUCTION OBLIGATIONS

Program statement

Estimated obligations fiscal year 1958	$2,500,000
(*a*) Obligations for new projects	(2,500,000)
(*b*) Obligations for prior year projects	(0)
Estimated obligations fiscal year 1957	0
Actual obligations fiscal year 1956	0

Obligations for the training, education and information program for fiscal year 1958 are estimated at $2,500,000, which is for the new project justified in section A below and which was authorized in the fiscal year 1958 Authorization Act.

SECTION A

The projects comprising section A are as follows:

Project No.	Title	Total estimated cost	Obligations incurred through fiscal year 1957	Estimated obligations, fiscal year 1958	Funding required after fiscal year 1958 to complete project
58-j-1	Nuclear training project, regional Nuclear Training Center, Puerto Rico.	$2,500,000	0	$2,500,000	0

Explanation of projects in section A

1. ***Project 58-j-1 Nuclear training project, Regional Nuclear Training Center, Puerto Rico, $2,500,000.***—This project provides for the construction on Government-owned land or under suitable lease arrangement, of a light water moderated and cooled pool-type training reactor rated at 1,000 kilowatts maximum power, a building to house the reactor, and adjacent nuclear training laboratory containing 2 hot cells and laboratory space, as well as space for maintenance and administration. A greenhouse about 20 by 100 feet in size will also be provided for agricultural research and training.

Construction of a Regional Nuclear Training Center in Puerto Rico is considered essential to furtherance of the President's atoms-for-peace program. Implementation of the atoms-for-peace program requires practical opportunities for people of participating nations to obtain training in nuclear technology, to take part in nuclear research, and to gain experience in developmental power activities.

These general needs are applicable to the Latin American nations in whose welfare the United States has long held a particular interest. This interest has been most recently exhibited in the statements at Panama by President Eisenhower regarding United States hopes for an expanded inter-American program of cooperation that would "* * * hasten the beneficial use of nuclear forces throughout the hemisphere, both in industry and in combating disease * * *"

Latin American interests in peaceful atomic activities can be best served immediately by providing for broad Latin American participation in the training and developmental activities prerequisite to attainment of a nuclear technological capability. Such participation can be greatly facilitated if these activities are undertaken in a familiar language and cultural environment which, for the great majority of Latin American peoples, is Spanish.

The University of Puerto Rico provides an excellent base for a nuclear training center. It is a well recognized institution and is equipped to assume on its two campuses the added responsibility of a nuclear training program.

58-J-1 NUCLEAR TRAINING PROJECT, PUERTO RICO

Mr. FIELDS. There is one item in this program, the nuclear training project at Puerto Rico in the amount of $2.5 million. This is a request for obligational authority for construction, on Government-owned land or under a suitable lease arrangement, of a training re-

actor with 1,000-kilowatt maximum power. Associated with that will be the building and a nuclear training laboratory containing hot cells and laboratory space. This would provide facilities for the support, housing and equipment that goes with this training project. This particular reactor is not the Puerto Rican power reactor that we previously mentioned.

Community Program—Construction Obligation

Mr. Boland. The next section is community program. We will insert pages 307 through 311.

(The information follows:)

Community Program, Construction Obligations

Program statement

Estimated obligations, fiscal year 1958	$6,731,000
A. Obligations for new projects	(3,159,000)
B. Obligations for prior year projects	(3,572,000)
Estimated obligations, fiscal year 1957	5,159,000
Actual obligations, fiscal year 1956	3,551,625

Obligations for the community program for fiscal year 1958 are estimated at $6,731,000, of which $3,159,000 is for new projects justified in section A below which were authorized in the fiscal year 1958 authorization act, or were previously authorized and for which a request for appropriation was deferred until fiscal year 1958. The balance of $3,572,000 is for projects listed under section B below which were authorized prior to fiscal year 1958 and for which funds have previously been appropriated but are now carried over into fiscal year 1958.

SECTION A

Project No.	Title	Total estimated cost	Obligations incurred through fiscal year 1957	Estimated obligations, fiscal year 1958	Funding required after fiscal year 1958 to complete projects
1. 58-k-1	Schools, Los Alamos, N. Mex.	$965,000	0	$965,000	0
2. 58-k-2	Housing modifications, Los Alamos, N. Mex.	1,000,000	0	1,000,000	0
3. 58-L	General plant projects	850,000	0	850,000	0
4. 58-RL	Retirement of community facilities	−10,000	0	−10,000	0
5. 57-j-1	Real estate development program, Los Alamos, N. Mex.	359,000	$5,000	354,000	0
	Total	3,164,000	5,000	3,159,000	0

EXPLANATION OF PROJECTS IN SECTION A

1. *58-k-1 Schools, Los Alamos, N. Mex., $965,000.*—This project provides for a new elementary school, an industrial arts shop and enlargement of auditorium-gymnasium facilities at existing elementary schools, a 1-story addition to the junior high school, and a 1-story addition to the high school, all of which are required to meet 1958–59 and subsequent year needs.

Analysis of school requirements shows that existing and authorized classrooms will be insufficient to meet the school year 1958–59 elementary enrollment. This is attributable to increased enrollment, transfer of existing classrooms from elementary use to meet increased junior high enrollment, and the closing of a temporary four-room elementary school which is beyond the point of economical maintenance. Optimum utilization of available classrooms is planned; nevertheless, Los Alamos schools will be deficient by 11 elementary classrooms. It is proposed to meet this need by constructing in the North Community a new

elementary school with 11 regular classrooms, 2 specialized classrooms (art and industrial arts shop), library, and auditorium-gymnasium facilities.

In addition to the new school, two existing elementary schools require improved stage facilities and expansion of gymnasium area. Canyon School has been dependent upon Central School for industrial arts instruction. The increase in enrollment will make it essential that Canyon have its own industrial arts shop.

The needs of the junior high school include construction of a combination study hall and library, additional music rooms, enlargement of dressing room facilities, and enlargement of office spaces. These needs emanate in part from increased enrollment and partly from the fact that the school was originally designed for use as an elementary school and does not contain facilities required by a junior high school. The high school requires a study hall (the library is now used for this purpose) and a multipurpose physical education room.

All projects will provide 42,500 square feet of additional floor space for schools. Construction is scheduled to start in August 1957, and completion in August 1958.

2. *58–k–2 Housing modifications, Los Alamos, $1 million.*—This project provides for the modification of up to 200 existing family housing units at Los Alamos. These modifications will include such items as providing bedroom and bathroom additions, enlarging kitchen and dining areas, adding storage space, and making such other alterations as are necessary to approach, in terms of quality of living space and desirability of features, standards of housing acceptable to top personnel of the Los Alamos Scientific Laboratory.

The senior staff and other key scientific and management personnel of the Laboratory are people with abilities in the highest demand throughout the country. The opportunities available to them are, therefore, numerous and attractive. Ranking high in the consideration given these opportunities is the fact that housing of quality and size much superior to that obtainable at Los Alamos is available in the other locations. This factor is of such weight that employment terminations, based wholly or in major part on the housing factor, have taken serious toll of the Laboratory's best people. Therefore, if we are to hold the present members of the Laboratory senior staff and attract others of equal rank to this isolated location, greater efforts toward providing housing commensurate with the stature and requirements of these people must be made. Their loss has handicapped, and could continue to seriously handicap the AEC in the performance of its mission. This project is considered the minimum that should be undertaken at this time.

3. *Project 58–L General plant projects, $850,000.*—This project covers alterations, additions, replacements, and other general improvements of various types which are anticipated for schools, city roads and streets, sewerage systems, municipal activities, water system, electrical distribution system, central steam plants, housing business concessions, hospital, and other community facilities. Normal operating requirements in past years indicate the needs for numerous capital items each year in order to provide the most economical operations of facilities at the various communities.

4. *85–RL Retirement of community facilities, —$10,000.*—This project represents income from sale of community properties with credits applied to community construction programs.

5. *57–j–1 Real estate development program, Los Alamos, N. Mex., $354,000.*—This proposal provides for the development of 72 lots to be sold to persons connected with the Los Alamos project for the construction of private residents. Barranca Mesa, which lies immediately north and in proximity to the main community, has been selected as the site for this development. The proposed development has been designed to conform with FHA subdivision requirements as to physical improvements, utilities, and lot layout. The estimate covers the cost of providing the necessary utilities, roads, appurtenances, and lot development. The sale price will be in accordance with VA and FHA appraisals.

There has long existed a professed desire by a significant element of the residents of Los Alamos to own their own homes. The expressed desire for homeownership has been manifested in exit interviews, public meetings on community affairs, and by individuals or small groups of individuals who have addressed themselves to the local offices of the Atomic Energy Commission.

Adequate housing has long been known to be a prime consideration in the attraction and retention at Los Alamos of the high-caliber technical and scientific personnel required to conduct the programs of the Laboratory. Evidence

in the form of recent turnover of senior staff members of the LASL confirms the fact that considerations of a comfortable home life are playing an ever-increasing role in their selection of employment opportunities. Under the proposed plan, personnel can obtain the type and size of housing they desire if an opportunity is afforded to purchase lots and to build homes on Barranca Mesa. Moreover, it would be possible for Laboratory personnel to spend their full working careers at Los Alamos, with assurance of being able, upon retirement, to remain residents of the community. Employees and their families must now vacate their present housing when their connection with the project is severed. Such permanence of residence would also make it possible to utilize the services of retired employees on a consulting basis. The total estimated cost of the project is $359,000. A total of $5,000 has been obligated for architect-engineering work, leaving a residual fund requirement of $354,000 in fiscal year 1958.

SECTION B

Project No.	Title	Total estimated cost	Obligations incurred through fiscal year 1957	Obligations to be incurred in fiscal year 1958	Funding required after fiscal year 1958 to complete project
1. 56-j-2	New community hospital, Oak Ridge, Tenn.	$2,900,000	$68,000	$2,832,000	0
2. D-57-1	Municipal facilities, Richland disposal	2,215,000	1,475,000	[1] 740,000	0
	Total	5,115,000	1,543,000	3,572,000	0

[1] Includes $50,000 for Richland library authorized by Public Law 802, 84th Cong.

COMMUNITY PROJECTS

Mr. FIELDS. In this program all of the projects for which we are requesting obligational authority of $3,159,000, with the exception of the general-plant projects in the amount of $850,000 which applies to all communities, are for facilities at Los Alamos. The first one is for additional schools in the amount of $965,000. The second is for modifications to housing at Los Alamos in the amount of $1 million. The last item in the amount of $359,000 is for the real-estate development program at Los Alamos, N. Mex., which was a 1957 authorization project. This latter project is for the development of an area of lots, and utility system so that the lots could be sold to persons who wished to build houses of their own near the Los Alamos community.

COMMUNITY IMPROVEMENTS AT RICHLAND

Mr. BOLAND. With reference to this particular section, I have here a letter from an anonymous contributor with reference to the operations of the AEC in these communities. I am not familiar with their plant operations, the writer says, but their city operations are apparent to all. The waste in unnecessary street construction, house maintenance, such as painting outside and inside, and new roofs, which they are selling to Richland tenants, is appalling. It is reported that they are spending $2 million on the streets and painting and another million in putting in water meters. They never needed water meters all these years. They gave free water to tenants. Now that they are selling the homes at ridiculously low prices, they also donate three-

quarters of a million dollars for water meters. What is the answer to that?

Mr. FIELDS. There are some improvements going on there. I would like Mr. Towne to speak to the specifics of this.

Mr. BOLAND. This is someone who is out there and works there and knows something about it.

Mr. TOWNE. I guess we will have to discuss this in parts of the question.

Mr. BOLAND. How about the streets?

Mr. TOWNE. The street-improvement program underway at Richland is a part of the construction program that was authorized under the Atomic Energy Community Act. I believe there was an authorization in the Community Act of $2,215,000 for a number of improvements, a large part of which was street-improvement work. There was an additional new facility, the city hall, all for the purpose of putting the town into condition for transfer to the residents upon incorporation.

The street system in Richland, when originally built, was built hastily during the war back in 1942. Over the years we have been securing appropriations gradually to put these streets in condition so that they would be suitable for permanent municipalities to take over without having to go into a capital-improvement program at the time they took over. The intent behind the Community Act is that the city government when it takes over will not immediately be in the position of having to acquire a bonded debt. If it did, then it would have the effect of causing our assistance payments to go up to cover the amount of the debt service.

Mr. BOLAND. We are not going to supply them with a model city with everything in great shape?

Mr. TOWNE. In reasonably good shape. I would not say they are perfect by any means. Many facilities will be perhaps less good than a normal community will. There will be some as good. I do not know of any that would be better.

With regard to the painting comments, and the reroofing of the houses, the painting and reroofing program at Richland is going along on the basis of continuing the normal cyclical maintenance of the real estate up to the date it is sold. This is a policy that was adopted before the sales program was started and it is continuing. For example, any house that has a 4-year-old paint job on it and comes due for repainting get repainted.

Mr. BOLAND. Your policy is a lot different than the Housing and Home Finance Administration. They have disposed of a good number of their projects under the Lanham Act and to get them to paint a house is really a problem. It is not a 4-year proposition, either. It is a 10-year proposition.

Mr. TOWNE. I am not familiar with that.

Mr. BOLAND. I don't know why it should be different here. This is apparently rather costly.

Mr. TOWNE. Yes. It is not an inexpensive program.

Mr. BOLAND. You are not going to get any less for the house on disposal because it is not painted.

Mr. TOWNE. The appraisal was based on the assumption that our normal maintenance program was continued. Whether the appraisal would have been affected one way or another, I could not answer.

Mr. BOLAND. How about the water meters?

Mr. TOWNE. The water meters were installed as a measure to conserve water in a situation where our water supply system was getting overtaxed. We had the option of either putting the water meters in and thereby avoiding expenditures to expand the water-treatment plant, or of going to a very expensive program of expanding the water-treatment facilities. Over the long pull, it would seem better to install the meters.

Mr. BOLAND. Is there anything in this particular item under general-plant projects that includes some additional money for the library in Richland?

Mr. TOWNE. The library is a part of the $2,215,000 that was in the authorization under the Community Act.

Mr. FIELDS. That is on page 311. That is in the item of $2,215,000.

Mr. BOLAND. How much will that library cost?

Mr. TOWNE. This is not a new library. It is the improvement of the existing library.

Mr. BOLAND. What is the cost of the improvement?

Mr. TOWNE. I think the estimate shown is $50,000.

Mr. BOLAND. What are you doing with $50,000? What is the improvement?

Mr. TOWNE. It is an expansion of the library facility to take care of the great increase in the use of the facility. This is a building that was remodeled from a building that was there during the war.

Mr. BOLAND. Are there any questions?

FHA APPRAISALS OF HOUSES AT RICHLAND

Mr. JENSEN. No. I have just one comment. I am sure that the people buying those homes are going to get homes for considerably less than homes outside the area would cost. I am not well enough informed on the amount that we are getting for these homes to be critical. I would like to ask this question. I have been in some of the homes although not recently in Hanford. There were some pretty nice homes there when I was there years ago. What does a conventionally built 2-bedroom home cost?

Mr. TOWNE. I have some typical FHA appraisals if you would like to hear a couple of them?

Mr. JENSEN. Yes.

Mr. TOWNE. A four-bedroom house, which is one of the largest and best houses in Richland, is appraised at $10,600, as of April 1956. There are only 8 of these 4-bedroom houses in Richland, so that is a relatively small number. There are about 250 3-bedroom houses, appraised at $9,000; another 250 3-bedroom units appraised at $8,100; some sixty 4-bedroom houses appraised at $12,300; 4-bedroom units at $10,400; twenty-five 2-bedroom units appraised at $12,000; nineteen 5-bedroom units appraised at $15,000. Then we have some less expensive ones, for example, 110 2-bedroom houses at $6,500, and 340 3-bedrooms at $8,300. These are FHA appraisals.

The Community Act provides that an occupant or other project-connected person can buy these at discounts up to 25 percent below these valuations. That is why there was a difference in what we gave you this morning between the appraised value and the proceeds of sales.

Mr. JENSEN. What is the average age of these homes?

Mr. TOWNE. They vary greatly. The houses that were built at the beginning of the project were built in 1942. After the AEC took over there were quite a number built around 1949–50, as I recall.

Mr. JENSEN. They are comparatively new homes. Those are considerably below the actual value of a home as of today. If you took off the 25 percent they would be.

Mr. TOWNE. The sales price is 25 percent below the evaluation. The FHA has testified that they regarded the evaluation as being appropriate to 1956 in comparability with the market in that area. Those are fair market values as they saw them at that time.

ORIGINAL INVESTMENT IN HOUSING

Mr. JENSEN. What was the cost of those homes?

Mr. TOWNE. They varied. The costs are not too meaningful.

Mr. JENSEN. I mean the total cost.

Mr. TOWNE. All of the real estate to be sold, including everything, the total valuation by the FHA was on the order of $80 million, whereas the book value less depreciation was around $81 million.

Mr. JENSEN. I know, but what was the original cost?

Mr. TOWNE. I don't have that. That would be the original cost without depreciation.

Mr. JENSEN. That is right.

Mr. TOWNE. We would have to supply that for the record.

Mr. JENSEN. I wish you would do that.

(The information follows:)

The original cost of those properties being offered for sale at Oak Ridge, Tenn., and Richland, Wash., is approximately $120 million.

Mr. JENSEN. That is all, Mr. Chairman.

ADMINISTRATIVE PROGRAM—CONSTRUCTION OBLIGATIONS

Mr. BOLAND. We will turn to the last section and insert pages 312 and 313.

(The information follows:)

ADMINISTRATIVE PROGRAM, CONSTRUCTION OBLIGATIONS

Program statement

Estimated obligations, fiscal year 1958	$3,623,000
A. Obligations for new projects	(450,000)
B. Obligations for prior year projects	(3,173,000)
Estimated obligations, fiscal year 1957	1,888,000
Actual obligations, fiscal year 1956	9,461,455

Obligations for the administrative program for fiscal year 1958 are estimated at $450,000 for the project, justified in section A below. This project was authorized in the fiscal year 1958 Authorization Act.

SECTION A

Project No.	Title	Total estimated cost	Funding through fiscal year 1957	Estimated obligations, fiscal year 1958	Funding required after fiscal year 1958 to complete project
58 L	General plant projects	$450,000	0	$450,000	0

Explanation of projects in section A

1. *Project No. 58 L General plant projects, $450,000.*—This project provides for alterations, additions, replacements, and other general improvements of various types at the Washington headquarters in Germantown, Md., and administrative facilities located in the field. Normal operating requirements necessitate a need for numerous capital items each year, many of which are of a recurring nature, for reasons of economy, safety, health protection, and efficient operations. In order to utilize existing buildings to their fullest extent, particularly where the buildings must accommodate increased numbers of personnel, alterations and additions must often be made. Building changes involve, for example, modifications of existing floor plans by the removal, addition, or relocation of partitions, and the relocation or extension of electrical, plumbing, and ventilating systems.

SECTION B

Project No.	Title	Total estimated cost	Funding through fiscal year 1957	Estimated obligations, fiscal year 1958	Funding required after fiscal year 1958 to complete project
5001	Headquarters building for AEC	$13,300,000	$10,127,000	$3,173,000	0

ADMINISTRATIVE CONSTRUCTION

Mr. FIELDS. We have 10 major-operations offices throughout the country and we have approximately 20 area offices. The general plant project in this program is for miscellaneous construction with respect to those offices.

Mr. BOLAND. Will you supply for the record the location of the area offices?

Mr. FIELDS. Yes, sir.

(The information follows:)

GEOGRAPHICAL LOCATION OF AREA OFFICES

Buffalo area office: Buffalo, N. Y.
Burlington area office: Burlington, Iowa
Kansas City area office: Kansas City, Mo.
Rocky Flats area office: Denver, Colo.
Sandia area office: Albuquerque, N. Mex.
South Albuquerque area office: Albuquerque, N. Mex.
Lockland area office: Cincinnati, Ohio
Pittsburgh area office: Pittsburgh, Pa.
Denver area office, Denver, Colo.
Salt Lake area office: Salt Lake City, Utah
Brookhaven area office: Upton, N. Y.
Fernald area office: Cincinnati, Ohio
New Brunswick area office: New Brunswick, N. J.
Paducah area office: Paducah, Ky.
Portsmouth area office: Portsmouth, Ohio.
St. Louis area office: St. Charles, Mo.
Los Alamos area office: Los Alamos, N. Mex.
Hartford area office: East Hartford, Conn.
Southern California area office: Canoga Park, Calif.
Dayton area office: Miamisburg, Ohio
Dana area office: Terre Haute, Ind.

Mr. BOLAND. That completes the hearing. Thank you, Commissioners Strauss, Libby, and Vance, for your attendance, and you, General Fields, and all the others.

Mr. STRAUSS. Thank you, Mr. Chairman. It has been a very helpful hearing for us, too.

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